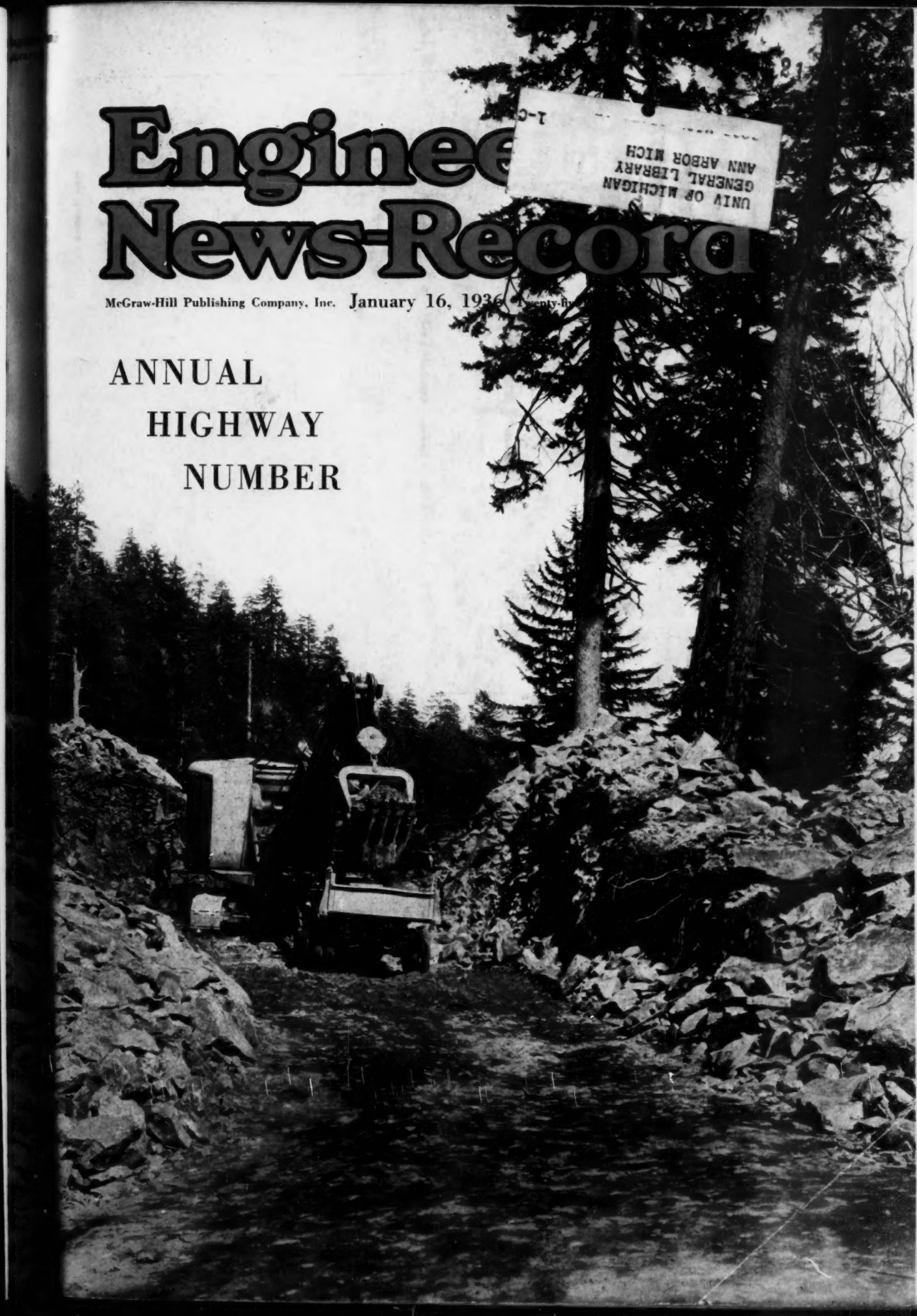

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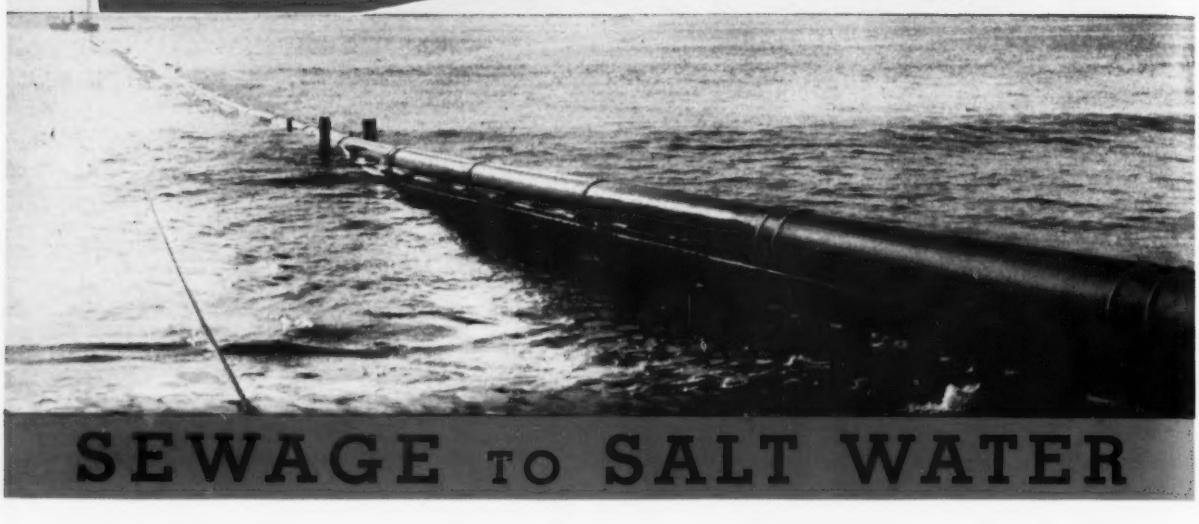
Engineering News-Record

McGraw-Hill Publishing Company, Inc. January 16, 1936 Twenty-fi

ANNUAL HIGHWAY NUMBER

WROUGHT IRON *Specified*



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The Road Builders Take Stock

AS THIS issue appears the highway clans will be gathering at Cleveland. Since January 1933 this is the first time that the American Road Builders' Association has attempted to hold its convention and show on the usual scale.

The confidence thus shown in the improved status and morale of the industry already has been amply justified. The manufacturers exhibiting at the show exceed in number and space requirements the most optimistic expectations. The Associated Equipment Distributors is holding its annual meeting in connection with the convention. The attendance of officials, engineers and contractors promises to attain a high mark; already reservations are several times those for the 1933 convention. It looks like a genuine "old-fashioned" road show and convention.

This demonstration of renewed courage and confidence is heartening; it will be more heartening to see that spirit turned to effective use on the problems that still beset the industry.

Chief of these is to get highway improvement out of the class of emergency work-relief measures and reestablish it once again as an essential factor in the vital industry of motor transport. This is easy to ask; it will not be so easy to perform. Already the crusaders for governmental economy are out to "slash public expenditures" and someone must help them to distinguish between what is worthy and what is wasteful.

THEN, too, many states have passed on to the federal government much of their responsibility for highway improvement; they have used its grants not to supplement their normal programs and thereby stimulate additional employment, but rather to eke out their own reduced appropriations. Even with the present trend of business recovery under way, these states will not be eager to resume their burdens.

All of which indicates the need for consistent effort to win for a sound highway program the sympathetic interest of those who want economy in the administration of government without crippling constructive and productive public activity. It calls also for an even more persistent fight on the vicious and indefensible practice of misapplying highway revenues to other than highway uses. In a few states the people have provided constitutional protection against this form of exploitation, but the practice still is so widespread as to constitute a major problem.

If we would make real progress in establishing highway improvement on a sound and stable basis, we must:

1. Have the construction, maintenance and administration of the highways recognized, not as just another government "expense," but in its true light as a productive public investment that makes possible the employment of millions of workers and billions of capital throughout a variety of private businesses and industries. *In this respect it is second to no other form of public investment.*
2. Plan in every state a balanced program for highway development that will consider its actual need for trunk routes, secondary and land-service roads and through streets; and, for each of those uses, develop the proper type of highway.
3. Make highway transport safer, so far as the roadway is a factor, by constant improvement of existing highways to meet traffic needs and by planning new roads according to the most advanced safety practice.
4. Raise the funds for highway improvement equitably from the three beneficiaries of motor transportation; i.e., the general community, owners of benefited land, users of the highways.
5. See that the cash revenues directly derived from the highway investment in the form of special taxes paid by motorists for their use of the highways are applied only to improve and maintain the highway plant.
6. See that the present federal emergency aid is tapered off gradually as states and local governments are able to resume their own programs, and that the federal aid policy of regular grants is continued indefinitely in order to insure continued federal aid and coordination of highway planning and practice.

THESE are but a few of the tasks that now face the highway industry. Each state and region has its local problems and the federal government must meet certain special overall problems. But unless these basic needs are met the others can be dealt with only on a basis of expediency and opportunism, leaving the industry vulnerable to political chance and the pressure of organized hostile or uninformed minorities. To oppose such a trend should be the major concern of an aroused industry.

Willard Chevalier

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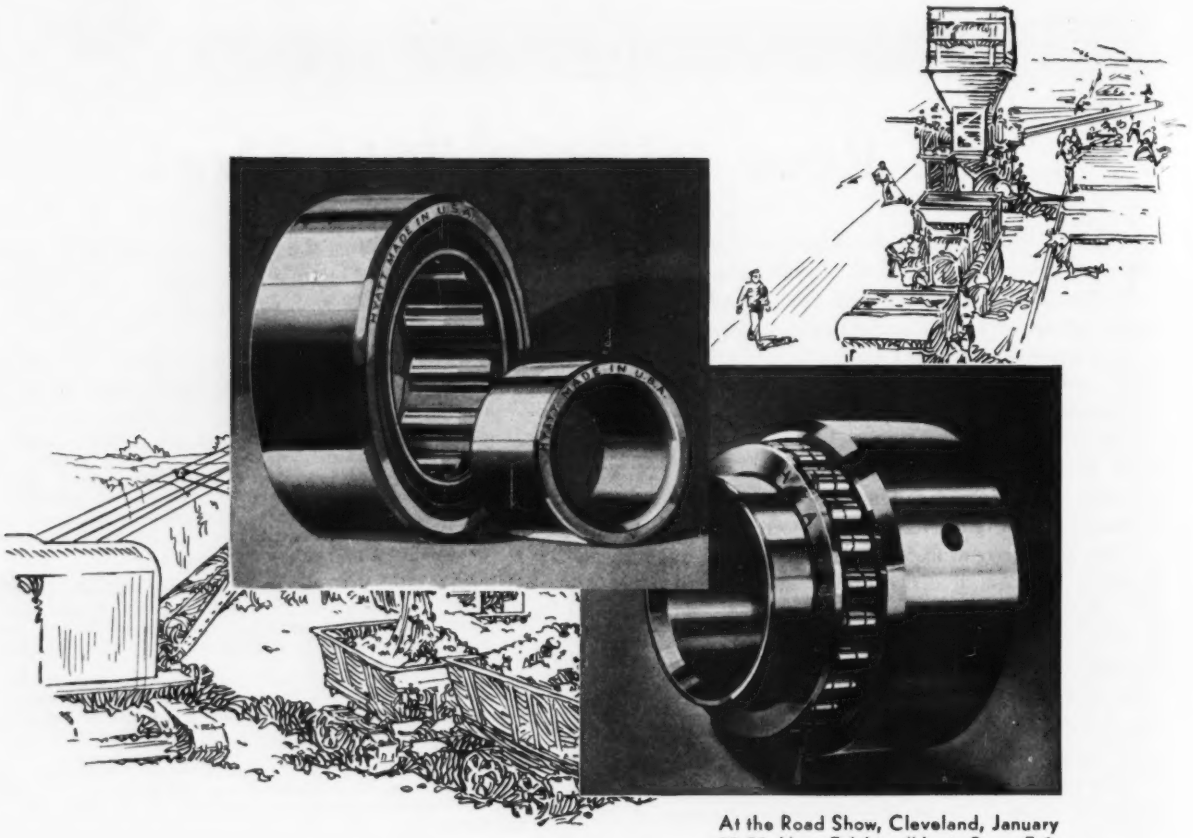

At the Road Show, Cleveland, January 20-29, Hyatt Exhibit will be in Space F-2.

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ANNUAL HIGHWAY NUMBER, JANUARY 16, 1936

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In the News:

MASON & WALSH COMPANY has relinquished its $7,000,000 contract for the driving of the Fort Peck Dam diversion tunnels, and the bores will be completed by government-hired labor, using the contractor's equipment and most of its organization. Inability to agree on prices for revised plans is given as the reason.

THE NEW YORK CITY TUNNEL AUTHORITY, newly created to meet the requirements accompanying a $58,365,000 PWA loan for the construction of the Queens-Midtown tubes under the East River, announced that the first contracts would be open for bids within a few weeks.

ONE IMPORTANT STRETCH in the motor highway from Canada to South America will be opened this May with the completion of the road between Mexico City and the United States border at Laredo. The Mexican government has appropriated $9,800,000 this year for road construction; part of the sum is for finishing the Pan-American route.

A 38-MILE PIPE LINE connecting Jerusalem with a reservoir 2,600 ft. below the city was completed, and a 2,000-year water shortage has been alleviated. The Holy City will now be supplied once every three days instead of every seven days.

RIVER AND HARBOR IMPROVEMENTS and maintenance in all sections of the country will cost $330,801,713 for the fiscal year 1937 if the recommendations of the Army Engineers are approved. Included in this budget is $20,000,000 for continued work on the Passamaquoddy tidal power project.

ALMOST EVERY PHASE of American life is under close scrutiny by the white-collar investigators employed on 650 widely diversified surveys conducted under WPA sponsorship at a cost of $29,000,000. These studies range from a review of the nutritional adequacy of home diets to inventories of the Tariff Commission records.

In This Issue:

SINCE 1929, publicity on highways has been directed mainly to subjects of relief work, financing and regulation. The road engineer has meanwhile kept improving his roadbuilding methods and construction plant. In five years both have become quite changed through cumulative growth in experience and invention.

INVENTORY AND APPRAISAL of this technical development are the purposes of this issue. Four major phases of roadbuilding have been selected in which roadbuilding authorities review recent developments leading up to the present advanced construction practices, policies and thinking.

I—CONSTRUCTION OF ROAD SURFACES, ranging from selected soils to high-type pavements, has witnessed greater advances in technique than most other elements of roadbuilding. This is exemplified in the construction of main types of surfacing discussed under road-structure standards.

II—SOUND PLANNING AND MANAGEMENT largely determine profit, and they are the first problems of the road constructor. His activity calls for high production during a comparatively brief construction period, and in order to maintain a proper schedule he must resort to extensive and expensive mechanization. The second section of this issue deals with the theory, principles and broad methods of sound planning of a road job, with specific applications to illustrate fundamental laws of procedure.

III—THE PROSECUTION AND SOLUTION of numerous problems incident to the construction of a highway can properly be classified as an integral part of the road survey. The range and scope of such survey information, its limits and its possibilities are exhaustively treated in an article on preconstruction aids.

IV—SUPERVISION AND CONTROL of road construction in the United States are extensive and have become quite diversified. The purpose of this final group of articles is to outline the organizational set-up and authority of:

1. The U. S. Bureau of Public Roads.
2. The state highway department.
3. The state testing laboratory.
4. The contractors construction organization.

INDEX

The index for Vol. 115, July to December, 1935, announced for publication with this issue, will not be published until Jan. 23. The change has been made because the present issue is a special number.

Coming Articles:

UTILIZING A SYSTEM of heated vapor drying and combustion in suspension, the sewage-sludge incinerator installed in the recently opened Calumet plant of the Chicago Sanitary District will reduce an average daily load of 40 tons of putrescible solids to an odorless inert ash. Details of equipment and method of operation will be described next week.

Cities Organize in Safety Drive
COUNTRY ALARMED OVER MOUNTING AUTO DEATHS
Civic Leaders Aroused
Two Drivers Get Stiff Fine; Jailed
Legislature To Pass New Driving Law

NATION DECLARES WAR ON ACCIDENT TOLL

"Keep in your lane!" say these Atlas White Concrete Traffic Markers on the Saugus River (Point of Pines) Bridge in Massachusetts. Center markers 8-inch wide. Broken markers 6-inch wide. Markers built on concrete base as curbing with asphalt top applied later. Installed for Massachusetts State Highway Dept. by C. J. Maney Construction Co., Boston.

● Here's a statement that's hard to believe:—In the last fifteen years 144,579 *more* Americans have been killed in automobile accidents than were killed in all the wars of our history!

Most of the fault must of course be laid smack in the laps of reckless drivers. But, despite earnest efforts to curb reckless driving, highway and traffic officials realize that what solution there is to the problem lies in making streets and highways as fool-driver proof as possible.

Permanent white concrete traffic markers are one thing officials have found helpful. These white concrete markers, made with *white* portland cement, combine constant visibility with economy. They are not merely surface markers—they are built right into the pavement—asphalt, brick or concrete. They can't be worn away. They never fade out. They are always white—always easy to see. Once in, they're in for good. We'll be glad to send you complete information. Address Universal Atlas Cement Co. (United States Steel Corporation Subsidiary), 208 South La Salle Street, Chicago.

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Made with Atlas White Portland Cement—Plain and Waterproofed

ENGINEERING NEWS-RECORD

ANNUAL HIGHWAY NUMBER

January 16. 1936

A ROAD RELOCATION and grade-separation on a federal-aid highway in the foothills of Montana.

❖

Roads and Roadbuilding Today

WITH THIS YEAR, by all present signs, highway construction will pass out of the field of emergency work and resume its normal course. For half a decade the roadbuilder's attention has been claimed by emergency requirements. Now the problems of planning, of design and of high-efficiency roadbuilding once more become controlling.

It is unnecessary to say that the changes of the past five years demand study. Roadbuilding requirements have become much more severe during this period. In order that the new practices and new appliances developed to meet them may be made fully effective, it is necessary to give careful thought to the bearing of present-day requirements on the construction task. To aid in this reorientation, leading highway engineers and construction men have cooperated to set forth in the present issue of *Engineering News-Record* a survey of practice in modern construction of surfaced roads.

Road construction centers in the mechanical processes of shaping materials into roadbed and surface for highest service performance. But its scope goes beyond field operations; due to the advance of recent years, it is concerned with preconstruction surveys, with the modernized construction contract, with skilful planning of plant and organization to utilize the powers of present-day equipment, and with the type of supervision.

Preliminary engineering today gives much help to the construction operations. Contracts give attention to labor and employment conditions, a change that is likely to be permanent. Advance in mechanization has given rise to major management problems. New standards as to materials and procedure of combining them into the finished road have resulted in surfaces of greater smoothness, gripping power and better structural resistance.

AHEAD OF US lies the problem of rationalizing the highway, and this goes far beyond the improvement of construction practices alone. Unquestionably a higher type of highway planning will have to be developed. So far we have done little more than tie together a series of neighborhood roads and equip them with stable surfaces; these roads are sure to be supplemented by a substantial network of express and truck roads. With this expansion will come better road administration. But we have yet to learn how to apply scientific method to road planning and operation.

Systematic research is likely to be the means of bringing about this further progress, in place of the present slow process of piecing together related experiences. In the development of transportation for greater service to human intercourse and wellbeing the highway engineer has opportunities for public usefulness greater than any he has found in the past.

Road-Structure Standards

Defined by

W. G. Sloan, C. G. Wahl, F. T. McAvoy and R. L. Morrison

THE ROADBUILDER of 1936 has to build better pavements than he did five years ago. The improvement is as pronounced in the surfaces for low-cost roads for neighborhood travel as in heavy-duty pavements of bituminous mixtures, brick and concrete for main traffic routes. The improvement also affects all parts of the surfacing structure: materials of superior quality are specified, they have to be combined more accurately, the elements of structure have to be adjusted to each other more effectively, and greater precision of workmanship has to be applied in all processes of fabrication.

All of these improvements combine to produce a superior structure calling for superior construction talent. One encounters difficulty in expressing these qualities and abilities in general terms; they have to be inferred from definition of materials and elements of structure and the order of processes that is required in combining them. But in the dullness of categorical narrative the acute reader will find the spirit of integrity and precision that characterize the construction of the modern road surfacing. It is a task that has come to have a refinement comparable with that of building and bridge fabrication and erection, and it is essentially different in different pavements, but with precision of operations dominating all.

In the bituminous macadam road the basic requirement is meticulous selection of materials and orderly combination of base, binding course and wearing course into an integral pavement structure; in brick paving the critical task is integration of the structural elements of base, cushion, brick surfacing and joint filler; in concrete paving it is the production of a stronger and sounder paving material; and in secondary surfacings it is the process of producing stable natural soils by cementation. These characteristics emerge clearly from what seems at first a confusing array of details in the four articles that follow.

The important indication is that construction calls universally for greater experience and skill, better organization and construction plant and a quality of management planning that have been only occasional in the past. Design studies, materials research and experience in service have left few openings for untrained constructors and inexact production.

Brick Pavement Processes

Without change in structural elements the construction of the modern brick pavement involves more machine processes and a more exacting selection and preparation of materials

CARL G. WAHL
Assistant Director and Chief Engineer, Ohio Department of Highways, Columbus, Ohio

ONE of the oldest road surfacings and perhaps the most conservative of all, in respect to change of construction practices, brick pavement has advanced to notably higher standards in materials and structure during the last five years. In all brick paving of the first order, constructors are faced with demands for better materials and far greater precision of workmanship. The elements of pavement — base, cushion course, brick and joint filler — remain the same, and so do the materials themselves, except for cushion. But the materials, the structural design and workmanship of today are of higher quality. This requires the constructor to exercise greater ability and skill.

How the constructor is to do his work cannot be told in the space available, even if it were possible to set forth a universal procedure that would hold true, but what the constructor will be required to do may be stated somewhat definitely and concisely. Practice in Ohio will be taken as the example; as a producer of paving brick and a user of brick pavement Ohio leads most states, and its practices fairly represent modern trends.

Present practice in brick pavement construction includes three general types: bituminous-filled, grout-filled, and monolithic. The vertical-fiber brick with projecting side and end lugs has largely replaced the brick with wire-cut side lugs and beveled ends. Four depths of brick—2½, 3, 3½ and 4 in.—are specified, the 3-in. depth being most generally used.

The pavement is constructed with a parabolic crown of 2 in. for a 20-ft. road. Prevailing practice is to build a smooth yet gritty non-skid surface; the wire-cut surface of the vertical-fiber paving brick is inherently gritty and is preserved in this condition in the monolithic and grout-filled types. Removal of the excess plastic filler, coupled with the introduction of comparatively non-exuding plastic fillers, has done much to preserve the initially gritty brick surface in the bituminous-filled type also.

Bases are in general constructed of concrete, using a 1-7½ nominal mix, 4.9 sacks of cement per cubic yard of concrete, and a water-cement ratio of not more than 7½ gal. of water per sack of cement. The concrete is designed by the absolute volume method; is mixed, placed, finished and cured in the usual manner. Bases are designed with a uniform thickness of 6 to 10 in., depending on the kind and amount of traffic the pavement will carry, and for heavy traffic are reinforced with a minimum of 52 lb. of fabricated steel reinforcement per 100 sq.ft.

Header practice

Bases for monolithic brick are constructed without headers. Bases for bituminous-filled and grout-filled pavements are constructed with two types of header; both are of the integral type, constructed at the same time as the base. The concrete type is usually 9 in. x 3½ in. and is constructed of the same concrete as is used in the base. The brick type is constructed by placing brick of

the proper size, depending on the depth of the paving brick to be used, in the green concrete and filling with a 1-2 cement grout. This type of curb is in fact a monolithic brick curb and is comparatively new. In addition, monolithic-concrete lane headers are sometimes constructed in the base to form a traffic line.

Cushion construction

Bedding courses with a uniform thickness of ¾ in. are used in all types of brick pavement except monolithic, in which the brick are placed directly on the green concrete. The bedding course or cushion is of two general types: untreated, consisting of sand, slag screenings, limestone screenings, or granulated slag; and treated, consisting of cement-sand, mastic, or powdered asphalt. Sand, slag screenings and limestone screenings are all placed in the same manner; they are spread on the base in a condition moist enough to be handled properly and are shaped with a reinforced templet. Granulated slag is rolled with a 5 to 10-ton tandem roller before shaping with the templet.

In the treated type of cushion, the sand to be used is dried and cooled before mixing. The cement-sand cushion, one part cement and six parts sand by volume, is mixed in a batch mixer, spread dry, and shaped in the same manner as a sand cushion. The water for hydration of the cement is provided by sprinkling the pavement after the brick have been placed. The mastic cushion is mixed in a pug mill or batch mixer, spread on the base and shaped with a double screed templet or finishing machine; it consists of 4 to 7 per cent (by weight) tar cutback or asphalt cutback and sand. This type of cushion, although comparatively new, appears promising.

The third type, the powdered asphalt cushion consists of 4 to 5½ per cent powdered asphalt and 5½ to 7½ per cent flux oil (by weight) mixed with sand that has been heated to 150-200 deg. F. This type of cushion is placed in the same manner as a mastic cushion. The templet used in shaping all cushions is of the compensating carriage type.

Laying the brick

Brick are piled in the proper quantities outside the curb and delivered to the bricklayers by gravity carriers. The brick are laid with uniform joints, the best wire cut side up and the lugs all in the same direction. Care is taken to obtain straight courses with the longitudinal joints broken at the center of each brick and the long dimensions of the brick perpendicular to the center line of the road. Where "batting in" is necessary along the edges or center the lugs are placed in the same direction as the other brick. Bats are not permitted to be less than one-third of a brick.

In the bituminous-filled and grout-filled types, as soon as the brick have been placed and culled they are rolled with a 5 to 10-ton tandem roller. Rolling is started at the side of the pavement, the roller being operated slowly parallel to the center line and worked inwardly until the center of the road is reached. The roller is operated so as to overlap its course each time. Rolling is continued until the brick are thoroughly and evenly embedded on the cushion. The monolithic type is rolled in the same manner with a hand roller. All brick broken under the roller are removed and replacement brick are tamped into position. Any portion of the pavement that shows more than ½ in. variation in 10 ft. or more than ⅜ in. of cushion forced up between the brick is relaid and rerolled.

In general two types of filler are used, bituminous and grout, the former predominating. The bituminous filler most generally used is a blown asphalt of comparatively high softening point (ring and ball, 75+ deg. C.) and a comparatively low temperature susceptibility. However, pitches have been used with success, and considerable experimentation is being carried on, both

CEMENT MACADAM ROAD receiving its penetration binder of cement grout previous to rolling and fine finishing.

PEELING EXCESS JOINT FILLER from a brick pavement is accomplished by spraying the brick-surface with a non-bonding liquid just before flooding on the filler material.

in the laboratory and in the field, to develop a non-exuding plastic filler.

In the bituminous-filled pavement the excess filler is removed, leaving the surface clean and the joints full. Immediately prior to the application of the filler the brick are treated with a separating agent of lime and water or calcium chloride, laundry starch and water. These separating agents are applied with a spray or other suitable device that is capable of producing a mist or fog in a manner that will coat the exposed surface of the brick and not penetrate the joints. The filler is heated in a kettle and poured on the pavement directly into the brick joints from buckets without the use of squeegees or other device. The surplus filler is scraped off in a manner that does not pull it out of the joints.

Grout filler is a mixture of two parts portland cement, one part hydrated lime, six parts sand. The grout is mixed in a mixer with sufficient water to insure complete penetration into the cracks. The brick are sprinkled and the thin grout is poured into the joints. The first application should fill the joints to 1 in. from the top. After this has settled and before the initial set takes place the joints are filled to the top with a thicker grout and if necessary refilled until the joints remain full. After the last application of grout has had time to settle the pavement is finished with a rubber-edged squeegee that is worked diagonally over the surface of the brick. This finish leaves a very thin coating of grout.

Joint construction

In the bituminous-filled pavement, transverse contraction joints in the base are spaced every 25 ft. and impressed longitudinal joints are made to separate the 10 or 12-ft. lanes. A tar-paper joint in the brick surface is placed immediately over each joint in the base. Additional tar paper joints to control cracking in the surface are placed over each crack that has developed in the base prior to the placing of the brick. In the grout-filled pavement, joints are the same as in the bituminous-filled except that in addition transverse expansion joints are placed at 100-ft. intervals. These joints are constructed of a 1-in. premolded non-exuding material and extend from the base up through the cushion and brick. In the monolithic pavement transverse expansion joints are spaced every 100 ft. and longitudinal center or lane joints are the impressed type. The expansion joints are the same as used in the grout-filled pavement. All joints, expansion, contraction and longitudinal, are doweled.

Summary

These details of structure indicate a refinement of construction operations that calls for the highest type of construction talent.

Building contractors who pass muster in the brick-paving operations of the coming years will require equipment and an understanding of nice construction greater than has been required in the past.

Improved Quality in Concrete

The trend toward better concrete characterizes five years of progress is continuing and promises to lead to higher peaks of strength and soundness

W. G. SLOAN
State Highway Engineer of New Jersey, Trenton, N. J.

DURING THE YEARS that have elapsed since the modern road began, and more particularly in the past five years, many improvements in the construction of concrete pavement have been made to the end that better road structure has been produced. By experimentation and study, it may fairly be anticipated, a still better pavement will be produced in the future. This assertion is founded on experience in New Jersey, where over 90 per cent of the improved state highway mileage is paved with concrete, but the conclusion is believed to be general. In developing the thought specific figures will be taken from New Jersey practice, which is the field of experience most fully known to the writer.

Steady increase of strength

The crushing strength of the cores taken from pavement undoubtedly gives some indication of the comparative quality of the concrete laid. It is interesting to note that since 1923 in the state of New Jersey the average strength of these cores, when 28 days old, has increased from 2,100 lb. per sq.in. to 6,100 lb. per sq.in. for the year just ending—see Fig. 1. The factors which have operated to achieve these results and which are a continuing influence include:

1. Cooperation by the manufacturers of cement in producing a material of greater strength and better workability.
2. Careful selection and grading of the aggregates.
3. More careful and uniform proportioning of the aggregates.
4. Reduction of the amount and careful control of mixing water.
5. Increase in the mixing time.
6. Improvement in equipment and methods for manipulating the concrete mixture.
7. Greater care and improved methods in curing the concrete.

Some of these factors have had a pronounced and immediate effect in improving the concrete. For instance, the change in measuring aggregates from volume to weight and the rigid control of mixing water which were put in effect during the year 1927-1928, showed an immediate increase in strength of some 1500 lb., as is evidenced in Fig. 1. The great increase shown between 1934 and 1935 is more difficult to ascribe to any one particular change, but is undoubtedly due to the fact that contracts covering work carried out during this period contained a provision requiring the contractor to guarantee a crushing strength of 5000 lb. per sq.in. at 28 days, as evidenced by the cores taken from the pavement, and in order to guarantee against any possible penalty on account of failure to produce concrete having this strength better workmanship and material, including cement of the highest quality, were generally used by the contractors. The cement companies in turn, seeing the trend of contractors to purchase only those cements which in the past have been yielding concrete of high strength, quite generally have improved their quality of cement.

Although it undoubtedly operated to produce better concrete, the fairness to the contractor of the strength-guarantee requirement is doubted by the writer; it has now been eliminated from the specifications.

Materials and mixing

The specifications covering cement during the whole period under discus-

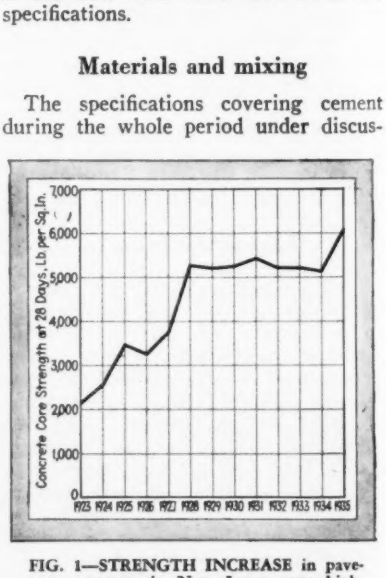

FIG. 1—STRENGTH INCREASE in pavement concrete in New Jersey state highways as indicated by cores crushed each year from 1923 to 1935.

sion have been those of the American Society for Testing Material, with the further requirement that laboratory cylinders constructed from the several cements and aggregates conforming to those specified for actual work in the field should produce a minimum required strength.

The specifications for coarse aggregate have permitted the use of either broken stone or gravel, and on the basis of the cores taken the strength of the concrete has shown up equally well in either case. A proper grading of the aggregates, however, has had an important bearing on the strength, and in order to insure the best possible grading and to avoid as much as possible the evils of segregation it has been required since 1928 that two graded sizes of coarse aggregate shall be used, which when combined would produce the desired grading.

The normal proportioning of the concrete mixture for pavements is 1 part cement, 1¾ parts sand and 3½ parts of coarse aggregate. The actual proportions are determined at the beginning of each paving project, with the material intended to be used on the project. During the last few years the actual proportions have been governed by the void content of the coarse aggregate. Most of the concrete laid has been mixed by batch mixers at the site of the work. Central mixed concrete is acceptable, but due to the distance of most of the paving projects from any central mixing plant and the large volume of concrete to be placed it is in general more economical for the contractor to install his batching plants and mixers at the site of the work.

Placing and finishing

The concrete having been placed it is finished by mechanical finishing machines of the screed type. Surface vibrators have been used to some extent, but, in the judgment of the writer, with indifferent results. It is required to use a vibrator of the spud type on that section of the pavement adjacent to the side forms and transverse joints. After the passage of the finishing machine, the surface of the concrete is broomed to remove any excess of mortar and to provide a roughened surface. This latter is important, both from the point of view of appearance and to provide a non-skid surface.

The curing of the finished pavement requires great care if satisfactory results are to be achieved. A considerable delay in covering the finished pavement may result in checking; on the other hand a too rapid covering sometimes results in a marking and unsatisfactory roughening of the surface of the pavement, which from the point of view of appearance, at least, is not desirable.

Until the last few years the curing was carried out by covering the pavement first with wet burlap until it had attained an initial set, and after removal of the burlap with hay, which was kept wet for the required period. The writer is of the opinion that this method still presents the most satisfactory method of curing, but with the advent of paper, fiber mats, and bituminous treatments of the surface, satisfactory means have been provided at less cost. In general the pavement may be opened to traffic 9 days after finishing during the summer months and somewhat later during the cold-weather months.

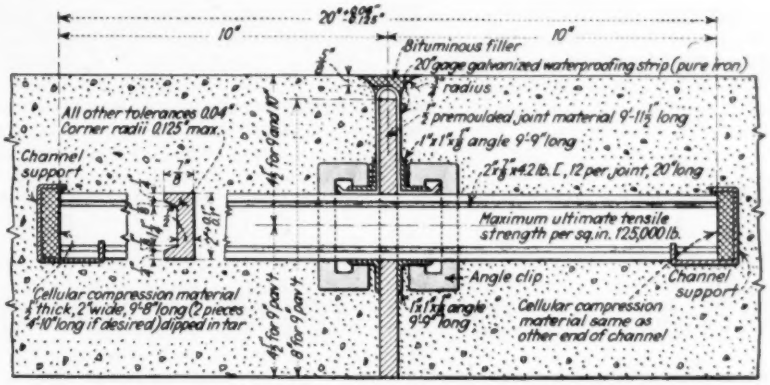
20'-8 15/16"
10"
10"
Bituminous filler
20 gage galvanized waterproofing strip (pure iron)
All other tolerances 0.04'
Corner radii 0.125' max.
Channel support
½ premoulded joint material 9'-11½" long
1"x1"x⅛" angle 9'-9" long
2 1/2"x4.2 lb. C., 12 per joint, 20' long
Maximum ultimate tensile strength per sq.in. 125,000 lb.
Angle clip
Channel support
Cellular compression material ½" thick, 2" wide, 9'-8" long (2 pieces 4'-10" long if desired) dipped in tar
1"x1½"x⅛" angle 9'-9" long
Cellular compression material same as other end of channel

FIG. 2—EXPANSION JOINT recently used on New Jersey state highways gives improved load transfer and dowel alignment, is watertight and does not exude bitumen.

Design developments

In New Jersey a uniform depth of slab is used on all pavement work, at the present time 9 in., except that pavements to be subjected to extremely heavy traffic in certain localities are built 10 in. thick. The slab length has within the past few years been increased to 56 ft. 4 in. instead of 34 ft. 4 in. which formerly obtained. The slabs are reinforced with steel, in the form of either welded wire fabric or mats built up of bars.

In addition to the mats heavier bars are inserted near the ends of the slabs to take care of possible corner breaks. The standard weight of bar mats is 76.85 lb. per 100 sq.ft.; the mats are placed 2 in. below the top surface of the slab.

The slab thickness and amount and position of the reinforcement used are the result of experience rather than of theoretical calculation. In fact it is quite impossible to make such calculations; no man can say whether traffic passing over the slab creates a greater destructive force than does the heaving of the pavement by frost action, nor whether due to the variable bearing power of the subgrade the slab is acting as a beam or as a cantilever. But we do know that concrete pavement constructed in accordance with the above described procedure is giving reasonably satisfactory results under very heavy traffic—surface wear is negligible and cracks are infrequent.

The weakest element is the transverse joint between the slabs. A joint is necessary at such intervals as will take care of the expansion and contraction due to temperature changes. The joint must be closed against the entrance of water which would adversely affect the subgrade, and because of the variation of subgrade some method of transmitting the stresses produced by moving traffic from one slab to the next should be provided at the start.

No method of accomplishing this in an entirely satisfactory manner, particularly under very heavy traffic, has yet been found, but distinct improvement has been made. The method of inserting six ¾ in. round dowels across the joint and filling the ½-in. open joint either with premolded joint filler or with liquid asphalt has been abandoned, for the reason that, due to expansion, large amounts of the filler were forced to the surface, making a poor riding pavement and upon subsequent contraction forming an open crack that permits water to reach the subgrade. Heavy traffic produced enough movement at the joint to cause pumping of the wet subgrade, which, aggravated by impact on the now irregular surface, assumed serious proportions. The round dowels in the meantime broke away the concrete in such manner as to enlarge the holes in which they rested, until they no longer functioned to hold the pavement surface in line.

Recently there has been devised and used quite satisfactorily a type of joint shown in Fig. 2. The dowels are increased in number and cross section, a 2½-in. channel section being used, and the metal cap just below the surface precludes the entrance of water. The amount of asphalt filler above the cap is so small that no considerable part of it is raised above the pavement surface by expansion. The dowels bear on angles where they enter the concrete, thus distributing the pressure, and the joint assembly assures that the dowels are exactly parallel and correctly placed in the concrete, which is extremely important.

This joint problem is, in my opinion, the most serious one we have in connection with concrete pavements today. It would be greatly minimized by subgrade stabilization, which matter is now being given serious study by many interested agencies, with promise of results of great value.

The advance in quality of concrete and the indicated improvements in structure that must come with experiment and experience present a definitely more exacting task of construction. This has to be looked forward to by the contractor in building up his organization, directing talent and construction plant for roadbuilding in the years ahead.

Bituminous-Macadam Practice

The roadbuilder's skill as craftsman and machine operator meets a severe test in recent requirements for bituminous-macadam construction

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BITUMINOUS MACADAM as it is considered here ranks leadership among bituminous constructions for rural main roads. As considered here also it ranks the equal of any pavement type in load resistance, durability and traffic service generally. In brief, bituminous macadam is considered by today's engineers as a distinctive type of road construction, and not merely a road surfacing.

Training and experience rather than elaborate equipment are called for its construction. But in no other type of road is thoroughness of procedure so rigidly required; constructors who can command the necessary skill and skilled workmen are at a premium.

Elements of structure

For illustration the practice of Massachusetts is drawn upon, this state having been the pioneer and the greatest builder of bituminous macadam main roads.

The first step in the construction of the penetration road is provision of adequate drainage. In loamy or clayey soils a subgrade of gravel is laid, or a stone base on top of about 4 in. of gravel. In wet and springy ground, side drains are built of broken stone and open-jointed sewer pipe, or ditches are provided along the sides of the road to keep the groundwater out of the subgrade.

The elimination of water in the subgrade is very important, and unless bleeders of porous material are built at regular intervals to carry the water out from under the pavement the subgrade may become saturated and lose its normal bearing power, or in cold weather cause heaving or frost action. These bleeders are especially important at low points in the profile, and here they should be built on both sides of the road to make certain that there is no ponding of water under the pavement.

After the roadbuilder has drained the road and provided suitable subgrade and shoulders, his next step is to roll the subgrade thoroughly with a heavy roller until no settlement can be discerned.

The bituminous macadam road in Massachusetts consists of a 2 to 3 in. top or wearing surface of 2¾ in. stone, bound with heavy asphalt. This top surface is usually laid on a broken-stone base 4 to 5 in. deep, which has been thoroughly rolled and bound up with dust or sand almost like a water-bound macadam road.

The materials necessary for construction are a hard and tough stone and a good grade of asphalt of the proper consistency. The stone should preferably be a good commercial trap rock or a local stone of equivalent value, having a French coefficient of wear not less than 14 and a toughness not less than 12. It should be available in No. 1 size, from 1¼ to 2¾ in. Inferior local stone may be used in the base course, provided it will pass a French coefficient of 10 and a toughness of 8.

It is very essential that a clean, uniform product is secured for this top 2½ in. penetration course, uniform both in quality and in size, for if it lacks uniformity in quality it will break up unevenly under the roller and give the same results as if it came non-uniform in size. This means an uneven penetration, causing weak places and fat spots, and a general lack of uniformity in the finished surface of the road.

The bituminous material required for this work may be one of two kinds which have certain prescribed properties, and among other requirements must meet the following: (a) Fluxed native lake asphalt shall have a penetration of 120 to 150; (b) oil asphalts shall have a penetration of 85 to 120.

The amount of machinery and equipment necessary for this work is probably smaller than for any other type of modern pavement. For that reason it is popular where expensive machinery is not at hand. Provided the stone is trucked to the job and the bituminous materials are sent out from a heating plant in a motor-sprayer, about the only machinery needed on the job are the steam roller and the mechanical stone spreader.

Construction requirements

Base Course—Upon the compact subgrade there is spread a layer of broken stone, preferably No. 1 stone, but if it is necessary to use the output of a crusher then No. 1 and No. 2 stone may be mixed, being careful that they are mixed uniformly and that there is not an excess of the No. 2 size. This layer is carefully spread, either from dumping boards or from self-spreading trucks, and after rolling is required to have a perfect cross-section 2 to 2½ in. below the desired finished surface. If depressions or high spots are visible, they must be carefully patched or removed, for the better the base is made the easier it is to obtain a perfect top surface.

UNDERPASS APPROACH CUTS call for extra slope finish of paving or sodding.

Up to this point no dust or sand binder are added, for it is considered important to get the maximum amount of mechanical bond before adding the binder or filler, and it is only when the roller will no longer leave its marks on the surface of the broken stone that the stone can be considered thoroughly rolled. In spreading the binder it is applied in two or three applications, while the roller is working; in no case should it be dumped on the surface of the broken stone. During the rolling of the base course, it is quite important to roll out on the shoulders for 12 to 18 in. to insure a strong compact shoulder that will not weaken or settle when the final rolling is being done on the finished surface.

After the base course has been bound up with the binder and rolled until it is thoroughly compacted, it resembles somewhat a waterbound macadam surface, except that it is not bound so tightly. The surplus binder is then broomed from the surface and the top or wearing course can be spread.

Top Course—The best results are obtained in the top course when No. 1 trap rock or its equivalent is used, being careful that there is no No. 2 or finer stone mixed with it. This trap rock should be spread with a mechanical spreader, and any dust, dirt and small stone should be thrown to one side.

Having spread the top stone carefully and having done all the patching that can be seen at the time, the roadbuilder rolls the top surface lightly and carefully, and continues the patching until the surface looks absolutely perfect. The patching is done with No. 1 stone only, and it is important to do it before the surface is rolled too much, as it is very hard to roll a patch into a well rolled road. The top course is 2½ in. thick, with 2 gal. of asphalt per sq.yd. When the stone is so rolled that the roller does not make a track on the stone, but before the stone begins to break up under the roller, the top course is ready for the bituminous material.

The asphalt is heated to a temperature of about 350 deg. and applied under a pressure of 60 lb. per sq.in., at a rate of 2 gal. per sq.yd. with a motor-distributor. If the distributor streaks and does not apply the asphalt uniformly, it should be stopped at once; the distributor should be removed from the top stone while the nozzles are being cleaned, or else a trough should be put under the nozzles while they are dripping and being cleaned.

Pea stone is at once thrown uniformly and lightly on the asphalt while it is still hot, and the surface is rolled while warm. The application of pea stone should be so light that the roller at all times will be bearing on the No. 1 stone and not on a cushion of pea stone. If the wheels of the roller stick to the asphalt, as they probably will in warm weather, they should be oiled. More pea stone should be added as the rolling takes place, until the surface has an even texture with the voids mostly filled, but with no loose or surplus pea stone on the surface.

After the first application of asphalt is covered with the proper amount of pea stone, and the surface is thoroughly rolled, then the surface is swept clean of all surplus pea stone, and the seal coat is applied.

The Seal Coat—The seal coat is applied at a rate of not over ½ gal. per sq.yd. It is even more important than in the penetration work that the asphalt be hot and the nozzles clean, for the distributor is moving about four times as fast while applying the seal coat. Tar paper or building paper should be spread down on the road and covered with sand at the point where the distributor is to be opened, and the distributor should begin far enough back from the point where it is proposed to begin spraying that it will have a flying start and be going at the proper speed when the nozzles are opened. After the load has been applied, the asphalt which landed on the paper is wrapped up and thrown to one side. If the work has been properly executed there will be a straight-line joint where the seal coat started, without a surplus of asphalt on the portion already sealed. Also if the work has been carefully done, the surface will not have a blot or fat spot on it; a fat spot is a defect in the road. These fat spots may be caused by dirty stone, small stone or stone spread too thin, or by overlapping either at the center joint or at the beginning or end of a load, all of which can and should be avoided to get perfect results.

The seal coat is now covered with ½-in. pea stone, using about the same method as outlined above for the penetration course, that is, being careful not to put too much on at any one time, keeping it free from bunches and keeping the roller going while the seal coat is still hot.

This final covering of pea stone consists of just a little more than will stick to the road; it is broomed about uniformly, and thoroughly and carefully rolled, this final rolling being very important, for there is then no danger of breaking the No. 1 stone. A 12- to 15-ton roller is better than the 10-ton roller for this final work.

After applying both the penetration and the seal coat, the bituminous material that overlaps on the shoulders is trimmed off to the line of the edges of the broken stone in order to get a good clean-looking line along the edges of the road.

During the past year many square yards of Penolithic pavement have been constructed in Massachusetts. The construction methods are very similar to the foregoing with the exception that the top course of broken stone is sprayed with ⅛ to ¼ gal. of mobile hydrocarbon oil just prior to the first application of asphalt, which in this case is at the rate of 1.2 to 1.5 gal. per sq.yd. The asphalt used is heavier, having a penetration of from 45 to 70. After the application of both the penetration and seal coat, the pea stone is applied as described above with the exception that prior to spreading, the stone is sprayed with the same type of oil used in spraying the coarse aggregate. The use of the hydrocarbon oil prior to penetration insures the complete envelopment of each fragment of the aggregate with asphalt, in fact more thorough penetration is attained and with a less amount of asphalt than in the ordinary methods of bituminous macadam construction. In addition, the use of a heavier asphalt gives a somewhat firmer surface and lessens the liability of pushing and bleeding. Another advantage is the fact that this type may be built at lower temperatures than the standard type.

Penetration macadam has changed little in its general elements during the

SODDING CUT SLOPES as a part of national recovery administration roadwork in Vermont.

last five years, but selection of material and precision of construction have improved. It should be repeated that bituminous macadam as a heavy-duty road surfacing is being considered here, and it is quite different from ordinary broken stone penetrated with asphalt or tar.

Secondary Road Surfaces

Grading to engineering standards and stabilized surfaces have promoted the local road to first position among present road types

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IN FIVE YEARS secondary road practice has attained engineering qualities; roadway and drainage structures are built to engineering standards, and traffic-resisting surfaces are general. Again prompted by local desire and encouraged by the need of distributing roadwork for unemployment relief, the mileage of secondary road improvement has increased enormously. In all respects the secondary road assumes at the beginning of 1936 increased engineering importance that calls for the best design and construction thinking by roadbuilders.

In the nature of things the main technical problems exist in surfacing practices, and for summary purposes these may be classified as (1) natural soil mixtures stabilized by deliquescent salts, (2) bituminous mixtures, and (3) cement macadam.

Stabilized soil surfaces

Since road dust is a source of annoyance, discomfort, danger and expense, its elimination early became one of the most important highway problems. A simple and complete solution is to replace the gravel surface with a pavement, but there are hundreds of thousands of miles where that is not economically justified, and there are more thousands of miles where funds for pavements are not available, regardless of economic justification. Under these conditions a comparatively inexpensive solution becomes imperative.

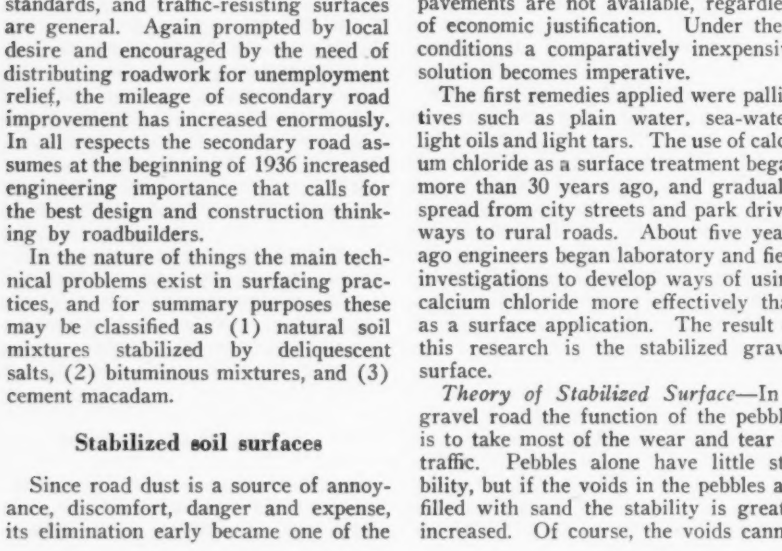
The first remedies applied were palliatives such as plain water, sea-water, light oils and light tars. The use of calcium chloride as a surface treatment began more than 30 years ago, and gradually spread from city streets and park driveways to rural roads. About five years ago engineers began laboratory and field investigations to develop ways of using calcium chloride more effectively than as a surface application. The result of this research is the stabilized gravel surface.

Theory of Stabilized Surface—In a gravel road the function of the pebbles is to take most of the wear and tear of traffic. Pebbles alone have little stability, but if the voids in the pebbles are filled with sand the stability is greatly increased. Of course, the voids cannot be entirely filled in this way and the sand itself has voids which, in turn, may be largely filled with silt, thus farther increasing the stability of the mixture, though some engineers believe that the silt has no function except as a reservoir for calcium chloride. The clay then acts as a filler of the remaining voids and also has properties which enable it to bind the mass together.

The process of stabilization, as covered by this discussion, consists of first proportioning the pebbles, sand, silt and clay so as to obtain the densest mixture of these materials and then adding calcium chloride to increase the binding power of the clay by stabilizing its moisture content. Reducing the rather involved theory of this action to simple terms, it may be said that when rain falls upon a stabilized surface the calcium chloride is carried downward from the surface by absorption. When the rain stops, and evaporation begins, the calcium chloride is drawn back to the surface by capillarity, and it again serves to keep the clay from drying out, thus preserving its maximum binding power and preventing the formation of dust.

Method of Construction—The proper proportions of the different materials must be determined in the laboratory after careful analysis and study of the characteristics of the clay and silt content. If clay is to be added, the road surface is scarified to a depth of about 3 in., and the proper amount of clay is spread. After the clay has dried it is mixed with the scarified gravel by such means as blading, rolling, and the action of traffic. Calcium chloride is added at the rate of about two tons per mile and mixed with the surface material with a blade grader or some type of maintainer. The road is then shaped up and given a surface application of about the same quantity of calcium chloride as was previously used.

There are variations from the methods and quantities outlined above, including the use in a few cases of mixing plants, and the substitution of sodium chloride for calcium chloride. Costs vary widely, but in some cases, at least, the initial application has cost about $250, and the cost of the completed job has been in the neighborhood of $2,000 per mile.



TRACTOR-POWERED CARRYALL SCRAPER, rooter and bulldozer indicate trend to heavy equipment in grading operations.

Bituminous surfaces

Bituminous surface treatments of waterbound macadam and gravel roads are, of course, not new. The treatment of macadam roads was first tried nearly 40 years ago, and there has been comparatively little change of technique in the last 25 years or more, except modifications of method due to improvements in equipment.

Although the surface treatment of macadam, slag and shell roads had been standardized before the World War, the similar treatment of gravel roads was

by no means uniformly successful. In fact, there were many failures and therefore an improvement of method was very desirable.

About 1923 a mixed-in-place method was developed in Wisconsin, and was rather widely adopted in other states. The essential feature was the mixing of the loose gravel and bituminous material on the road with a blade grader. The next development was the premixed or plant-mix method. Numerous variations of these methods were evolved, the terms retread, oil-mix, and road-mix came into use, and there has been considerable confusion both as to methods and designations.

The low-cost bituminous surfaces may be classified into three general types, as follows: (1) surface treatments, or seal coats; (2) surfaces mixed on the road; and (3) surfaces mixed in a plant.

The last two classes may be further divided into graded-aggregate types and ungraded or macadam-aggregate types, thus giving five classes instead of three.

Surface Treatments—Surface treatments, first used on waterbound macadam roads, consisted merely in the application of a coat of tar, or heavy oil, covered with stone-chips, but in some cases it was found that a priming coat of lighter material was desirable. The reason for the prime coat was that, under many conditions, a material light enough to penetrate the existing road surface would not stand the wear of traffic, while a material heavy enough for the traffic would not penetrate sufficiently to stick to the stone.

Present practice, with macadam, gravel, sand-clay and similar surfaces, consists of the application of a prime coat of about ¼ or ⅓ gal. per sq.yd. of light tar oil, which is allowed to soak into the surface for about 24 hours, and is then followed by an application of about the same quantity of heavier material. This is covered with about 30 lb. of stone or slag chips or pea gravel.

Surface treatments eliminate the dust, greatly reduce annual costs, and presumably reduce the cost of vehicle operation. However, they add little, if anything, to the load-supporting capacity of the road, except through waterproofing action. The cost of these treatments, in many cases, has been from 10 to 15c. per square yard.

Road Mixes—The road-mix type was developed primarily in an effort to get something more substantial than a surface treatment, but less expensive than a pavement. It is obviously impossible to give more than the barest outline of procedure in this brief article, the main object being to distinguish between the different types.

For the macadam-aggregate type the original surface is put in proper shape and given a prime coat. Crushed gravel, stone or slag is then spread to a depth of 1½ to 2½ in., and sprayed with tar, asphalt emulsion, or cutback asphalt, in two or three applications. Thorough coating of the aggregate is obtained by blading with a grader or multiple-blade drag, and the coated aggregate is then spread out and rolled, after which a seal coat is applied.

The general method of construction of the graded aggregate type is similar to that described above, but the aggregate is well graded, from ¾ to 1¼ in. size down to sand and dust.

Plant Mixes—Either the macadam-aggregate or graded-aggregate types may be mixed at a central plant, which gives more accurate control and is increasing in favor, though the cost is a little higher than for the road-mix method.

Traveling plants, which pick up the windrowed aggregate from the surface, may be considered as furnishing a type of construction intermediate between the road-mix ind the plant-mix types.

Naturally, there is a wide variation in the cost of these thicker surfaces, but one survey showed costs ranging from $1,000 to $3,000 per mile per inch of depth or from $2,000 to $4,000 per mile total cost. Widths of the surfaces were not given.

Cement-bound macadam

A cement-bound macadam street was laid in Scotland 63 years ago, and for several years, beginning in 1905, cement-bound macadam was laid in this country under the name of Hassamite. About three years ago this type of construction was revived to meet the necessities of the economic situation.

Essentially, cement-bound macadam consists of a layer of coarse crushed stone, rolled to a depth of about 6 in., the voids being subsequently filled with cement grout. The grout consists of 1 part of portland cement to 2 parts of sand and 7 to 8 gal. of water per sack of cement. It is applied through a chute attached to the mixer. Immediately after the grouting the surface is rolled with a light tandem roller, and the road is usually cured with wet burlap for 48 hours.

Such concrete contains far more coarse aggregate than does that produced by the usual mixing method and the cost is considerably less, some jobs having cost about $1 a sq.yd.

Summary and forecast

In the last five years several factors have combined to add to the importance of the low-cost road types. The most obvious one is the decrease in available construction funds; another is the fact that in many states the most heavily traveled highways have already been paved, and a third is the tendency in several states toward the administration of township roads by country or state highway departments. This stimulates the use of something more substantial and effective than can be produced by the haphazard methods of untrained local officials, but the cost must necessarily be kept down. Finally, there is the constant desire of the engineer to accomplish given results, in the way of service to traffic, with the smallest expenditure of taxpayers' money.

Although the development of these surfaces was stimulated by the present economic difficulties, there is no reason why they should not be widely used on secondary roads, even in most prosperous times, and such use seems very probable. Indications are that the different types have become fairly well standardized, and that no radical changes are likely to occur in the near future. Constant improvement and refinement of equipment and methods, including more accurate technical control, are to be expected.

FOREST ROADS in national parks and preserves offer in many cases rare opportunities to give work to local supplies of men and teams.

Planned Management

Requirements Outlined by

T. Warren Allen, J. L. Harrison and A. W. Anderson

ROAD SURFACING, as described in the preceding section, calls for both mass production and a refined product. Each requirement has become more exacting in the last five years, and now there is a demand for volume, speed and precision in road surfacing that has to be met by job planning of superior quality. Former standards are no longer criteria of proficiency; overall management has to be improved, the assembling of materials has to be more perfect, and their transportation to the work must be made more certain and expeditious.

The study of these problems by the division of management of the Bureau of Public Roads has been the most complete and has extended over the longest time of any study ever made of construction methods. The conditions arrived at and the principles evolved are summarized in the three articles that follow by engineers who have been engaged in this extended investigation.

The difficulties of the process of laying down surfaces on road subgrades are centered in the servicing operations of job coordination, assembling materials and hauling them to the pavement-laying unit. Each is a complex task in which many factors have to be relatively appraised and their values integrated into a coordinated train of economic operations. The articles that follow head into this general thesis but outline and substantiate by example general rules of procedure that have been found effective.

The fundamental consideration is that now and in the years to come planned management is demanded to meet the exacting quality of product, the volume and speed of production and the fierce competition of road pavement types and of roadbuilders seeking business. Moreover this work must be carried out under a system of administrative and laboratory supervision, described later, that is increasingly rigid and exacting.

Designing an Organization

Successful construction management requires that the construction organization and plant shall be a planned design coordinated to economic production

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IN HIGHWAY CONSTRUCTION, as the contractor must view it, the overall objective is profit. Another, though a closely related thought concerning the management of construction is that, invariably, any correct approach to profit must involve definite planning as distinct from haphazard organization. This planning involves the development of some definite arrangement of equipment and of working forces, this arrangement being designed to result in the greatest possible production per work-dollar expended. It would hardly be going too far to say that this is the key to successful production management.

Hold to horse sense

In the interest of clarity it should perhaps be remarked that the term work-dollar, as used in this discussion, means the dollar used to perform the work which must be done on or about the job. Fundamentally, construction involves taking materials and making some new thing out of them which is worth more than the raw materials were worth. Some of this work is done by human labor, some by animal labor, some by mechanical labor. But this work must be done whether the desired new things are embankments, pavements, bridges or what not. It naturally follows that, to secure a profit, the cost of the raw materials, plus the cost of performing the work done on them must be less than the value of the finished product.

For obvious reasons the cost of the raw materials is not likely to be much affected by job practices. But job organization and construction practices can and do greatly affect the cost of performing the work which is involved in converting the raw materials into a finished product. Hence the contractor's interest in the production secured per work-dollar expended, that is, per dollar spent in performing the conversions which his work involves.

This at once leads to the next point on which it is necessary that some emphasis be laid. The contractor is not fundamentally interested in securing the greatest possible production per hour or per day. Nor has he any fundamental interest in big machines or in mechanization as distinct from hand labor methods. His interest is in the amount of production he can secure per work-dollar spent. Moreover, this interest attaches to the production of his organization taken as a whole rather than to the production of some particular part or parts of it.

In practice, this is likely to mean that a very keen interest must be maintained in mechanization, for it always is a probability, though it is by no means always a certainty that mechanization affords the best approach to low production cost. For the same reason some interest must be maintained in high rates of production. But these are virtues only when they result in more production per dollar; they become definitely a liability as soon as they result in less production per work-dollar expended.

In any sort of construction work there are almost an infinite number of arrangements of equipment, working forces and animals that will result in a workable production organization. Under each of these some pretty definite rate of production per work-dollar—or, to state it inversely some pretty definite work cost per unit produced—will result. The contractor's proper objective in organizing his work is, then, to keep this rate of production per work-dollar spent as high, or, for those who prefer to think

of this matter in that way, to keep the work cost per unit produced as low, as possible.

And this fact should be kept definitely in mind—it makes not one whit of difference to the contractor how this is done! More than once the writer has seen a string of scrawny mules that were making more money for their owner than a nearby power shovel of marvelous design, because the old timer who owned the mules packed around in the back of his head a keen appreciation of the fact that, after all, it didn't matter much how his outfit looked as long as the cost at which it moved dirt was attractive.

Some guide posts

How can one determine which is the best combination of men, animals and machines to use? As between combinations of substantially equal merit, exact determinations are difficult. However, there are some guide posts which if carefully observed will prevent serious errors.

The first of these is that in the highway field most construction work involves mass production. Combinations of labor and machines not suited to mass production are to be avoided on all large operations though they sometimes prove profitable on small operations.

Another important generalization is that in all major items of construction work commonly encountered in the highway field the finished product is the result of several successive operations rather than of a single operation. Where a finished product is the result of several successive operations or processes, the output of the organization taken as a whole cannot exceed the capacity of the most inefficiently handled operation in the series. This is the most arbitrary and the most inflexible rule with which contractors must deal—a rule to which far too little respect is paid—the one rule of which it can be said that any lack of respect for it invariably results in a loss of potential profit.

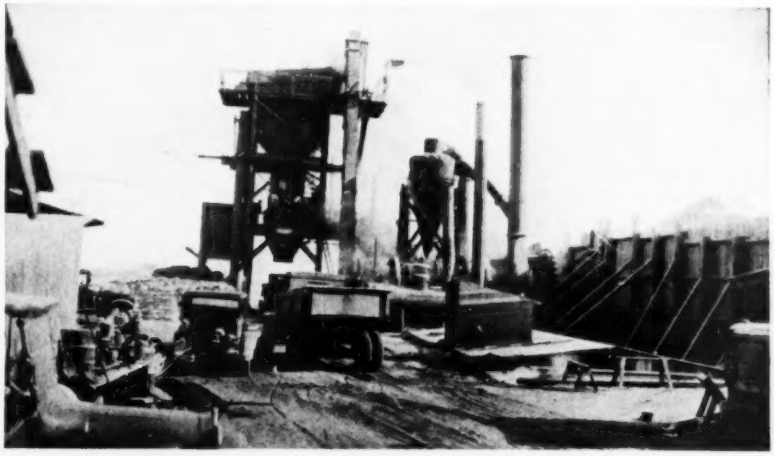
This rule, and its inflexibility, may be illustrated by referring to a simple power shovel job. The shovel digs and loads the material, the trucks haul it, the bulldozer distributes it on the dump and the rollers compact it. As stated, four successive and definitely interdependent operations are involved. But—and here is the point—no matter what the capacity of the shovel may be, it cannot dig any more than the trucks can haul. By the same token, no matter how many trucks are provided, they cannot haul any more than the shovel can dig. The two processes are so definitely interdependent that without the slightest regard to the quality of the shovel or the capacity of the trucks neither can force general output above the capacity of the other.

This is rather a simple series of operations, but it serves as well as any to illustrate the fact that production at a proper cost does not result from having a good shovel or a good mixer or good trucks, but from having a well-designed organization—good throughout. It also serves to illustrate the fact that inevitably a well-designed organization is one so designed that the productive capacity of each of the operations of production involved is equal to the productive capacity of all of the other operations.

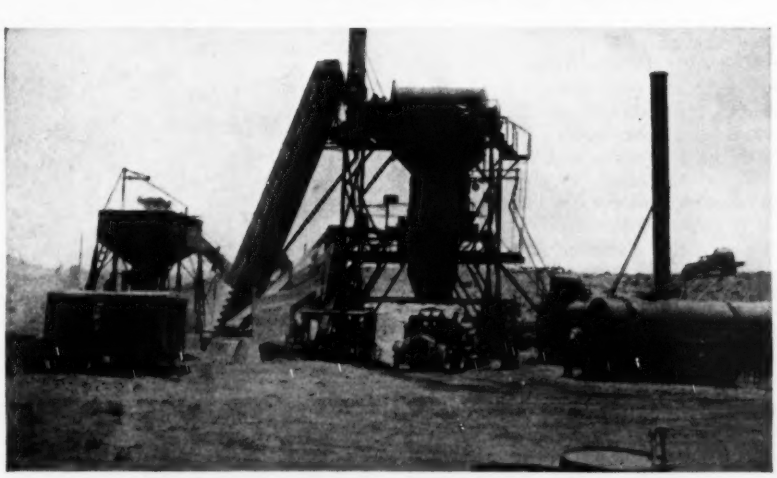
Finally, good organization design requires that this equality in productive capacity must be based on some practical rational rate of output. In the grading field, and fundamental considerations are the same here as in any other construction work handled on a mass production basis, this rate may be set at 75 cu.yd. or 100 cu.yd. or perhaps at 125 yd. per hour. The capacity of the available shovel, the amount of working room, the nature of the materials to be handled, a thousand and one things, may enter into the determination of this rate of production. But once this rate is determined, if it is to be attained, the construction organization—every part of it—must be planned and tooled to validate this rate. This means that each successive process involved in the development of finished units must be considered separately, and as the result of this separate consideration assigned whatever equipment and whatever men may be needed to give it the required capacity—not some capacity or a lot of capacity but the capacity that is required to permit it to support production at the rate selected for that particular job.

Making the analysis

Reverting to the problem of determining which of several types of organization is the best, a simple solution is now apparent. It lies in the analysis of the relative cost of various organization arrangements as applied to specific operations. Take this same grading operation—and again the principle is of universal applicability wherever mass production is used in the highway field. A power shovel is to be sent out, and production is to be maintained at 90 cu.yd. an hour. Teams and wagons, trucks or tractors are available for hauling. The



GATES FEEDING DIRECTLY into the cold elevator pit from behind the stockpile bulkheads are easy to install and operate but are difficult to regulate closely.



THE FEEDING BIN may be loaded with either crane or belt conveyor and usually permits an easier and closer regulation of the feed of the cold materials to the drier.

BITUMINOUS MIXER discharged into spreader boxes reduces materially the amount of shoveling and raking.

crux of the whole matter is the rate of output selected for the job as a whole. Once that rate, in this case 90 cu.yd. an hour, is fixed, and it is definitely realized that the problem is to validate that rate for the job as a whole, it becomes a simple matter to calculate the amount of each of any available types of equipment which must be provided to validate it, and to determine what costs each type of planting will generate. The problem is indeterminate only as long as the rate of production is allowed to remain in the realm of things hoped for.

Some emphasis has been laid on the necessity for designing the construction organization to meet a selected rate of production. This has been done for several reasons. It has been shown that it is only by proceeding in this fashion that satisfactory production can be secured. The fact has also been very briefly noted that only when this is done can the relative desirability of possible alternate styles or organization be subjected to close analysis. It should also be observed that it is only when and as organizations are definitely designed to validate definite rates of production that tooling problems can be solved with any confidence in the accuracy of the solutions reached.

Modern mass production in the highway field is fundamentally a matter of correct, balanced tooling. But machines run at pretty fixed rates. True, some of them can be operated at variable rates. Still, by and large, they are constant-speed units, and even if variable speeds are possible constant speeds are preferable. If the planning and tooling of construction operations are done on any other basis than for some selected rate of output, inevitably some processes will be undertooled and some overtooled. The unescapable result is that, except in the undertooled operation, equipment is constantly worked at less than its reasonable capacity. Costs are thereby increased, and the work done per work-dollar expended is sharply decreased, because of interest, depreciation and other charges on the surplus capacity of the equipment assigned to the processes in which the output is below capacity.

Sensible mechanization

This deserves a good deal of emphasis, for, while good equipment always is desirable, nothing whatever is gained by a contractor when he buys a piece of equipment merely because it is big or new. What he needs is a piece of equipment that will fit into his production scheme—that will support the rate of production at which his organization, taken as a whole, is designed to operate. A piece of equipment, no matter how fine it is, that has double the output rate that his organization is designed to support, cannot decrease his costs and may readily cause him a loss unless he retools his whole organization to sustain the higher rate at which this new piece of equipment is designed to operate.

This suggests another matter of some importance to contractors. Does it always pay to build "bigger and better" organizations? By no means. The writer once asked a large contractor why he had never bought a larger asphalt plant. He had several 1,000-lb. plants—none larger. On the job where he was working at the time he had installed two 1,000-lb. plants. A 2,000-lb. plant would have produced more cheaply.

Said he, "The answer is very simple. I get 10 jobs for a 1,000-lb. plant to one where a 2,000-lb. plant would really be an economy. On this job it would be. It's two years since I've had the last one big enough for such a plant. In the meantime I've had a dozen jobs on which the additional cost of getting the bigger plant onto the job, erecting it and getting it away again, to say nothing of depreciation on the extra investment in it, would have been far greater than any possible savings on production cost." The point is obvious. The ideal organization is one tooled and manned to fit jobs of the size usually available!

To summarize very briefly the points so far made, the objective in contracting is profit. Profit depends on getting the most work possible done for every work-dollar spent. Getting the most work done for each work-dollar spent requires, first, and above all, an organization so designed both as to plant and as to personnel, that its capacity to handle each process is equal to the output the job is expected to maintain. The manner in which the various parts of a construction organization are tooled and manned is of somewhat less importance but still is of far too much importance in successful contracting to permit of its being overlooked.

Animals, men or machines?

There are a great many operations on which a number of widely different kinds of equipment can be used to perform a given class of work. Hauling is an illustration. It can often be done by horses and wagons, or by trucks, or by tractors. Some operations, too, offer a choice between hand labor and machines. There still are some operations in which there is real competition between animal power and mechanical power. In tooling any process the first consideration is that the tooling be such as to guarantee the desired rate of output. This is vital. No type of equipment on which dependence cannot be placed to support the required rate should be given any further consideration. But as between possible arrangements of human labor, animal labor and mechanical equipment on which dependence can be placed there will often still remain a considerable variety of arrangements from which to choose.

There are several things to consider here. The use of hand labor requires little or no investment. The out-of-pocket cost for wages, with a very little for hand tools, is the total cost. The use of animal labor involves some investment, perhaps quite a little, but the investment in animals can be liquidated rather easily and without other losses than buying and selling costs and the cost of such depreciation in the value of the animals as may have resulted from their use. The use of mechanical equipment requires large investments, large and somewhat intangible rates of depreciation, and, speaking generally, little possibility of liquidation except through continued operation during its valuable life.

In making a choice between the use of hand labor, animal labor and mechanical equipment, as a means of handling a specific process, the objective is the lowest overall cost of performing the work involved. For performance by hand labor this is almost wholly a cost for wages. Where mechanical equipment is used, it is the total of the wages, the operating expense of the machines used and their depreciation. For operation in the contractor's usual field mechanical equipment is likely to show the low-

est costs. On jobs in a field not usually entered, hand labor methods are sometimes the better choice (unless equipment can be rented at a reasonable rate) even if the cost be somewhat higher, because no investment is involved.

Selecting the equipment

After determining how the various parts of the construction organization are to be manned and equipped, which for most processes will mean after determining that they are to be mechanically equipped, the contractor must determine just what specific make and kind of equipment he will select. This is a particularly important question when the selection involves purchasing new machines. Here there are three things to consider: Functional adequacy, dependability and operating cost.

Reference has already been made to the fact that the capacity of any new machine purchased should harmonize with the rate of output that is to be maintained. It is a waste of money to buy a shovel capable of digging 150 cu.yd. an hour if the balance of the grading outfit with which it is to work has a capacity of only 75 yd. an hour and is to be maintained on that basis. It is suicidal to purchase a 75-yd. machine if the organization is built to handle 100 yd. an hour and is to be maintained on that basis. The machine to be obtained is one that fits the organization in which it will work.

In this connection it is to be observed that in the grading field in particular the trend during the past five years has been toward the construction of larger and larger shovels and of larger dirt-moving equipment of other kinds. There is real justification for this, as there has been a definite tendency in the design of highways to increase the yardage moved per mile of new highway built. There also has been a marked tendency to use refined alignments regardless of the materials encountered. This has increased the depth of cuts and the volume of rock work. These changes have tended to increase the size of the jobs offered contractors and accordingly to increase the desirable capacity of organizations working in this field.

On this account the contractor who is keeping abreast of the times will, quite generally, find that it is to his advantage to purchase larger dirt-moving units today than he would have purchased five years ago. But if this is to prove profitable, the whole dirt-moving organization must be correspondingly revised. In short, during the past several years, the amount of dirt the average grading project involves has increased, and there has been equal or perhaps even greater progress in the development of dirt-moving equipment. Bigger and better construction outfits are justified by the change in highway design, and they are made possible by changes in the design of equipment. But neither of these changes has altered the fundamental fact that if the contractor's organization is to work at a higher rate of output than it has worked in the past, every part of it must be equipped to validate that higher rate.

GOOD UTILIZATION of a limited space. Potential losses from insufficient room for stockpile storage are partly offset by use of large bins.

No one aspect of equipment is more important than its dependability, its ability to work hour after hour and day after day without any loss of working time. The machine which is constantly breaking down or which must be stopped every little while for repairs or for minor adjustments reduces output without correspondingly reducing cost. It interferes with maintaining and often disrupts operating schedules, destroys efficiency and breaks down morale. Machines which lack dependability are a liability no contractor can afford. It is, therefore, a real pleasure to be able to remark that manufacturers seem to be keenly alive to this fact and that their appreciation of the importance of dependability is reflected in the constant improvement in this particular, of the road-building machinery which they have offered during recent years.

In commenting on this matter, a representative of one of the paver manufacturers recently remarked to the writer that the machine his company is now offering is normally in better condition, has fewer breakdowns and causes fewer delays for minor adjustments, after laying 100 miles of 20 ft. pavement, than machines built five years ago had after laying 30 to 40 miles of 18 ft. pavement. This same sort of improvement has been taking place in all types of highway construction equipment. It is important to contractors and offers a very cogent reason for replacing any old equipment that is not now thoroughly dependable.

The cost at which equipment can be operated, though in effect not as important as dependability, is worthy of consideration whenever tooling a job or tooling a single process is under consideration. The most outstanding improvement in highway construction equipment which has taken place in the last five years is the introduction of diesel engines as the source of power. They are now available as power units for pretty nearly all types of equipment on which power is used. Economical, dependable and relatively long-lived, contractors have never before been able to obtain the power required in performing the work highway construction involves at anywhere near the cost at which it has been made available to them by the introduction of these engines. No contractor can afford to ignore diesel power when he is considering new equipment.

Beside those improvements in equipment which involve obvious reductions in the fundamental cost of operation, a good many new designs offer minor refinements which result in lower operating cost or which result in savings when operation is at or near the capacity rate. All such improvements deserve consideration and many of them will be found to generate real reductions in operating cost. It may, however, be remarked again that if operating costs are reducible only when a unit is to operate at or near its capacity rate, the contractor is not likely to benefit unless he *will* operate it at this rate.

Theory reviewed

The theory of successful construction management set up in this article is that a construction organization can be and should be a matter of planned design. In making this design, each process should be considered separately and such plant and such personnel provided for it as may be required to guarantee that it can support the rate of production the organization, taken as a whole, is expected to maintain. Finally, in tooling the various operations, the equipment which is selected should be functionally adequate and thoroughly dependable. Also it should have the lowest obtainable operating cost. In short, a construction organization can be and should be the result of definite planning. Also, it should be tooled as a balanced organization, designed to operate smoothly at a predetermined rate. Having been

planned to operate at this rate, it should be operated at this rate. This is the responsibility of the superintendent. Give him an organization that is properly designed and then insist that he run it correctly! The nub of the situation is in the design. Thousands of men can drive a car; not very many could design one and then build it.

Organizations are a bit the same. Many men can handle a well designed organization effectively. Not so many can design it correctly. The approach to satisfactory profit is in organization design, in planning and planting the organization correctly. If this is done, it can be run successfully and profitably. In short, the organization that is built correctly can be made to run correctly. Certainly vigorous direction is still required. But with a properly built organization, this vigor can be effectively applied to force satisfactory results, and should be.

Increased Hauling Efficiency

Present rates of production demand a calculated number of hauling units and a closely-timed schedule for moving them

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THE PRINCIPLES that govern efficient hauling are general and apply as directly to hauling for roadway grading as in transportation for surfacing, which is selected here for specific consideration. During the past five years great changes affecting hauling have occurred; hauling equipment has been much improved, and the volume of hauling has increased. But the vital change is that hauling has become a scheduled operation attuned to materials supply and pavement laying. These requirements can be fulfilled only by exact planning. The first-class building contractor knows to a day when he will place a certain piece of structural steel in the tenth story of a building he has contracted to build. The highway contractor though confronted with more conditions not subject to his control should nevertheless be able to approximate building procedure in programming his work.

Hauling practice needs improving

What is true of the job as a whole is true of the haul item, which in ordinary highway paving operations sometimes amounts to nearly 20 per cent of the total cost and is therefore an item warranting critical study. Its place in the program and its cost must be carefully determined. Specifications governing the work must be taken into account, especially those which relate to the mixing operations. This is particularly true in the case of concrete paving, where because of the continued standardization on the 27E paver the mixing rate sets the maximum possible rate of progress for the whole job and for each of its individual activities.

A somewhat different situation obtains on bituminous-concrete highway work, where the mixing plant during the last several years has been developed from plants mixing about 1,000-lb. batches to plants mixing about 5,400-lb. batches, with a corresponding average production increase from around 15 tons per hour to around 140 tons per hour. Again, in bituminous paving operations we note the development of the "gob box" for storage at the mixer, which eliminates waits by the hauling unit for mixed batches.

The portland-cement concrete-batching plant compels the multiple-batch truck to await the preparation of all except batch No. 1. Similarly, at the mixer the multiple-batch truck, particularly if it holds over two batches, must wait to dump each of its batches. These are items the equipment manufacturing industries involved should take under consideration. I see no valid reason why the present 27E paver should not be supplemented by one of double the capacity, and believe thought should be given to the development of a modified "gob box," perhaps built in series, one above the other, at the batcher plant, and to the development of adjuncts at the paver to obviate waiting to dump by multiple-batch trucks. It is surprising to me that competition has not brought about such improvements before this.

The delivery of materials to the job seems a simple proposition, yet lack of its efficient handling has been a very fruitful source of loss to contractors. The delivery of paving materials adequate in total quantity must be at a rate to synchronize fully with the rate of demand or production of the key producer—the mixing plant. The maximum rate at which the mixer may operate is definitely fixed by specifications and mechanical operating requirements. Any decrease in production during any period of time because of insufficiency in delivery of materials cannot be made up during any subsequent period; any such loss is irretrievable. The main objective of haulage, therefore, must be such regularity in the delivery of the materials as will fully conform with the production rate of the mixer.

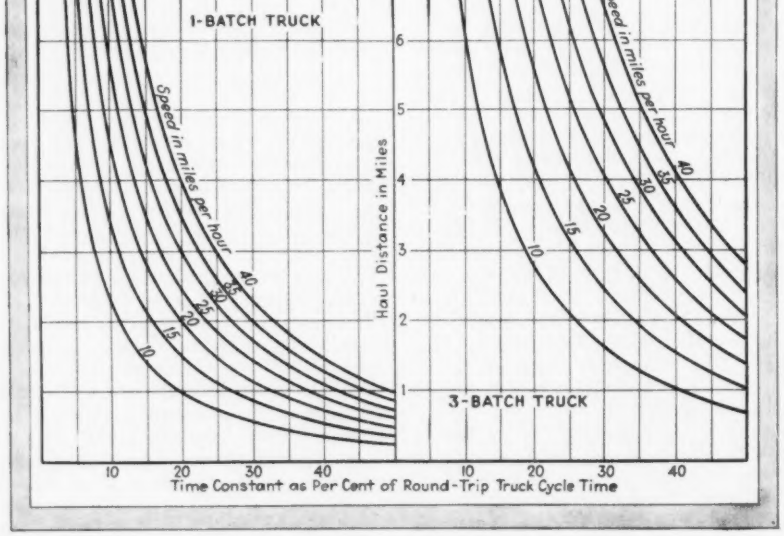

FIG. 3—TIME CONSTANT GRAPH, showing importance at various hauls and speeds of time consumed otherwise than in travel in per cent of round-trip travel

How many hauling units?

To insure regularity in the delivery of materials it is necessary to have the proper number of hauling units, and these units must be operated on a carefully worked-out schedule to avoid bunching of trucks at one point and consequent irregular delivery. The number of these may be ascertained through use of one of the graphs shown;

Fig. 4 is for portland-cement concrete work. In each case the formula upon which the figure is based is shown on the graph. The formulas give the number of trucks needed to meet the demands of the mixer. Contractors usually find it advisable to provide a slight oversupply as an insurance against unavoidable delays, especially where the haul is long or road conditions are poor.

A study of these figures is well worth while. Let us, for example, take Fig. 4 for portland-cement concrete paving. The instructions for use of the figure are printed upon it. The actual haul will vary from day to day and the contractor may with the aid of the formula or the figure ascertain his truck requirements as the work progresses. Let us assume as an illustration of the use of the figure an average one-way haul of 5 miles. Let us also assume a speed of 10 miles and draw a line on the figure through 5 the haul mileage and 10 the average speed and extend it to *a* on base line *A*.

The next step is to estimate the "time constant," the time spent on the round trip at other times than when actually hauling. On a considerable number of projects studied where three-batch trucks were used the time constant averaged about 12.5 min.; on individual jobs it varied from this as much as 25 per cent. Thus on a poorly managed job the time constant often ran up to about 15½ min. Using this and drawing a line from *a* on base line *A* to 15½ on the time constant scale we cross base line *B* at *b*. A line drawn from *b* to 3, the line denoting number of batches hauled, crosses the base line *C* at *c*. If the paver is run at a little below its batch capacity, this would be around 45 batches an hour and if through this point on line *Q* at the bottom of the figure and point *c* a line is drawn and extended to the line *N* at the top of the figure we get about 19, the number of three-batch trucks necessary to put out 45 batches an hour. The inefficient contractor will not secure this output because he rarely, if ever, has enough trucks on the job. He is more likely to have but 15 or 16 and secure not to exceed 35 batches an hour.

On the other hand, the more efficient contractor on the same 5-mile haul would keep his haul road in such condition that he could maintain an average truck speed of at least 20 miles an hour and probably find ways of cutting his time constant to 9 min. Use of the figure will show for such a condition a need of but eight three-batch trucks to secure the 35 batches for which the inefficient contractor would use 15 or 16, and to secure 45 batches the more efficient contractor would require but 10 trucks. These examples show plainly the principal use to which both Figs. 4 and 5 may be put and indicate the variations in production which result from variations in management.

It is quite evident from the foregoing that road speed is an important factor in the determination of hauling requirements. Actual hauling speeds as observed on the job vary with many conditions, the chief of which are the surface condition of the hauling road, grades, curves and widths; the traffic as to kind and density and especially as to the amount of cross-traffic, traffic lights, and grade crossings; the equipments as to type, size and mechanical condition; and last but not least, length of haul. On short hauls average round-trip speeds are invariably found to be low. This is also true to varying degrees for congested traffic conditions, steep grades, sharp curves and poor mechanical condition of the hauling units.

Nor do all the vehicles have to be in poor mechanical condition to demoralize hauling speeds. One or two slow units in the truck supply will be sufficient to reduce materially the average hauling speed of the entire outfit. The Tables I and II illustrate some of the variations in average hauling speeds which are found from job to job as well as from time to time on the same job as road conditions vary and the length of haul increases or decreases. Actual average hauling speeds may be expected to vary, as shown in these tables, from about 6 to over 40 miles an hour. These tables are for batch hauling on portland cement concrete paving construction, but it is believed they are approximately correct for bituminous concrete paving construction.

The time constant is also indicated as an item that must be carefully watched. On well-managed portland-cement con-

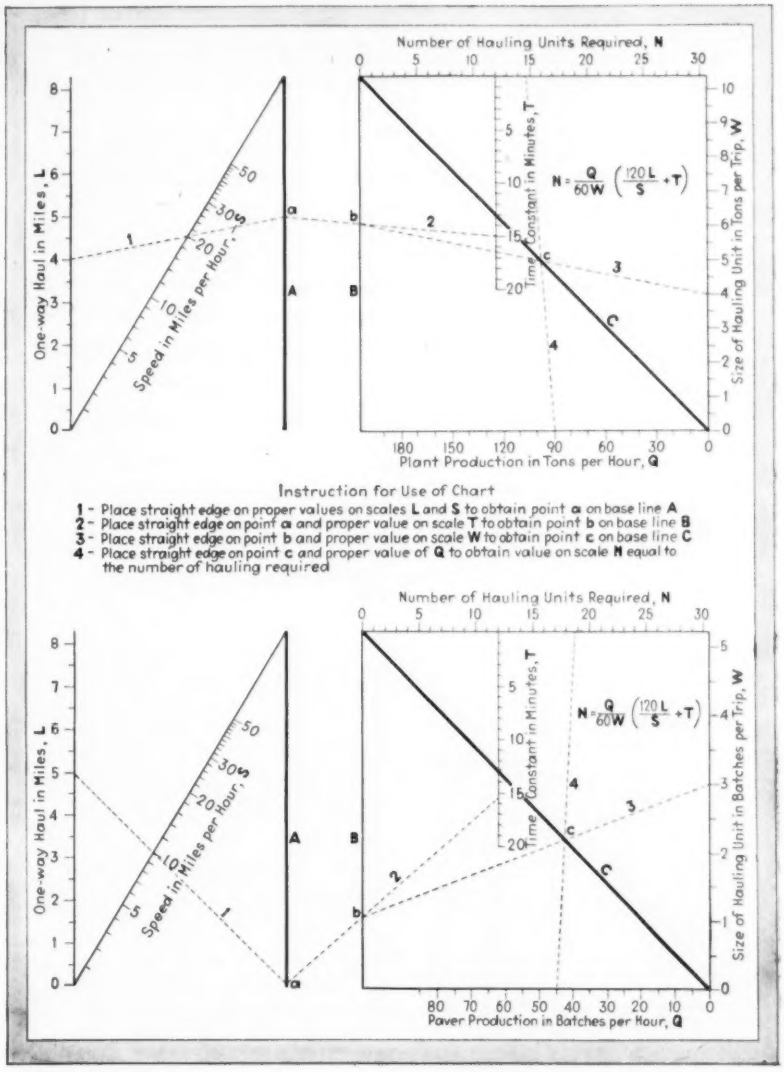
Number of Hauling Units Required, N
0 5 10 15 20 25 30
One-way Haul in Miles, L
Speed in Miles per Hour, S
Time Constant in Minutes, T
Size of Hauling Unit in Tons per Trip, W
$N = \frac{Q}{60W}\left(\frac{120L}{S}+T\right)$
Plant Production in Tons per Hour, Q
180 150 120 90 60 30 0
Instruction for Use of Chart
1 - Place straight edge on proper values on scales L and S to obtain point a on base line A
2 - Place straight edge on point a and proper value on scale T to obtain point b on base line B
3 - Place straight edge on point b and proper value on scale W to obtain point c on base line C
4 - Place straight edge on point c and proper value of Q to obtain value on scale N equal to the number of hauling required
Number of Hauling Units Required, N
0 5 10 15 20 25 30
One-way Haul in Miles, L
Speed in Miles per Hour, S
Time Constant in Minutes, T
Size of Hauling Unit in Batches per Trip, W
$N = \frac{Q}{60W}\left(\frac{120L}{S}+T\right)$
Paver Production in Batches per Hour, Q
80 70 60 50 40 30 20 10 0

FIG. 4 (TOP)—HAULING CHART for concrete paving with formula for calculating number of hauling units required for various distances, speeds, truck sizes, etc.

FIG. 5 (BOTTOM)—HAULING CHART for bituminous paving with formula for calculating number of hauling units for various distances, speeds, truck sizes, etc.

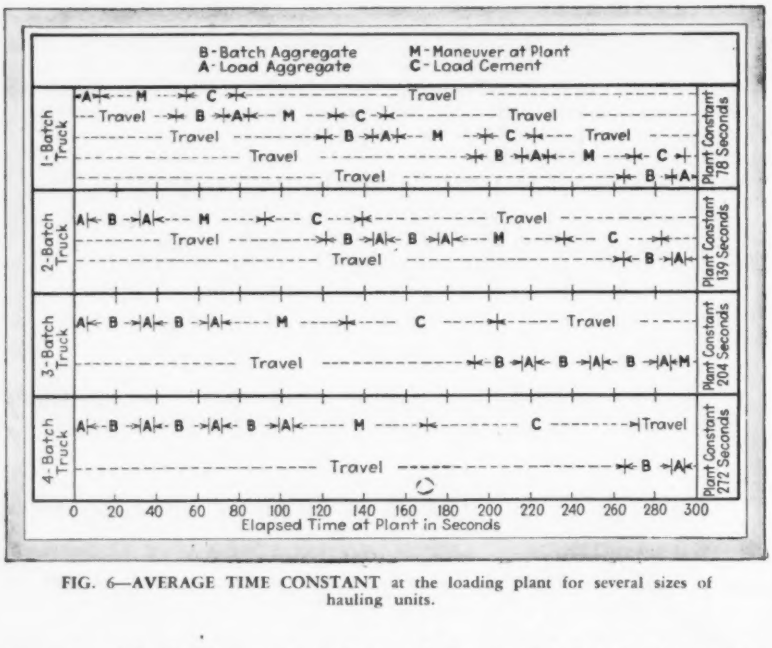

FIG. 6—AVERAGE TIME CONSTANT at the loading plant for several sizes of hauling units.

crete paving jobs the time constants for the trucks used in hauling (that is, the average time spent in the loading plant plus the time spent at the mixer plus regular delays on the road may be expected to be for each trip about as shown below in Table III when the mixer operates on a cycle of 90 sec. It must be understood, however, that these are average values based on about 100 jobs and that even on well-managed individual jobs these values may readily vary as much as 25 per cent. The influence of the time constant varies with the haul distance, and on very short hauls becomes a large percentage of the total round-trip time. Fig. 3 is illustrative of the importance of the time constant on batch haul. Table III shows for portland-cement concrete paving the average time constant compared with the necessary time (delays excluded) for hauling units of various capacity.

TABLE III—AVERAGE TIME CONSTANTS BASED ON 100 OPERATIONS

	Time Constant in Minutes	
	Average	If No Delays
1-batch trucks	4.0	3.0
2-batch trucks	8.0	5.5
3-batch trucks	12.5	8.3
4-batch trucks	17.5	10.7

For bituminous concrete paving, the following show average time constants for a considerable number of jobs—many of which, however, did not use a gob box:

	Minutes
Plant constant	11.4
Road constant	5.8
Total time constant	17.2

For various-size hauling units, the following requirements are indicated:

	Minutes
Trucks under 2 tons	7.8
Trucks from 2 to 3½ tons	8.8
Trucks over 3½ tons	9.7

It is essential that the time constant be kept as low as possible. Reducing the time constant reduces round-trip time and permits increased production. The loading time can be kept at a minimum by proper selection and operation of the loading equipment. The time consumed in turning and backing at the plant can be reduced and possibly eliminated altogether by adequate planning in laying out the plant and arranging the loading equipment. The time for turning and backing at the site of surfacing can also be reduced by providing adequate turning space and reducing the backing distance as much as possible. The dumping time may also be reduced. The small delays per trip for such causes as waiting to receive or to dump load, etc., should be kept at a minimum. A reduction in the total time constant, as illustrated by the examples shown in the use of Fig. 4, results in a reduction in the unit hauling cost. Figs. 6 and 7 show representative or average values of the necessary time constant for the several sizes of hauling unit, at the plant and at the road.

TABLE IV—EFFECT OF LENGTH OF HAUL AND ROAD CONDITIONS ON AVERAGE ROUND-TRIP SPEED. DATA ARE FROM FOUR FAIRLY TYPICAL JOBS

Job No.	Hauling Conditions	Length of Haul, Miles	Average Round-Trip Speed Miles per Hour
1	Good pavement, 3-batch trucks, excellent condition	1.58	27.1
		1.81	27.5
		2.04	28.3
		4.35	33.7
		4.97	37.2
		6.24	40.2
2	Earth and gravel road, fair to poor; 2-batch trucks, fair condition	.18	6.0
		.46	10.9
		1.17	16.5
		1.73	17.4
3	Earth road, fair condition; 1-batch trucks, fair condition	.52	9.8
		.80	11.4
		1.02	13.1
		1.48	15.8
		1.87	16.5
		2.45	17.1
4	Earth, gravel and pavement, fair to poor; 3-batch trucks, fair condition	.66	7.2
		.95	8.1
		1.20	8.2
		1.78	8.7
		2.08	10.8
		2.30	10.4

When trucks are hired

The tendency to sublet the hauling or to hire individually owned trucks with drivers on a ton-mile or batch-mile basis is apparently increasing, although no completely satisfactory basis for such contract hauling has as yet been devised. The conditions controlling operating efficiency on this type of work seem to establish a conflicting or opposing set of interests between the two parties. The interest of the hauling contractor is to have on the job the smallest possible number of trucks which can transport the materials at the average rate demanded by the mixer. Any excess truck capacity simply means reduced net earnings. But the mixer, whether concrete or bituminous, never works at a continually uniform rate for any extended period. Furthermore, the mixing time and mechanical and other definite conditions strictly fix the maximum rate. But from time to time, for longer or shorter irregular intervals this maximum rate is usually attained.

To permit the attainment of this maximum possible rate the hauling equipment supply must be fully sufficient to handle the maximum production rate. This means that there will be an oversupply of hauling units for all periods during which the mixer is working below maximum capacity. But idle or waiting trucks on the job mean decreased profits to the hauling contractor without any penalty to the main contractor. On the other hand, lack of sufficient trucks to keep the mixer operating at maximum capacity, whenever it can do so, imposes no automatic penalty on the hauling contractor but a

TABLE V—EFFECT OF LENGTH OF HAUL AND ROAD CONDITION ON AVERAGE ROUND-TRIP SPEED; 1-BATCH TRUCKS IN GOOD CONDITION

Condition of Road	Length of Haul, Miles	Average Round-Trip Speed Miles per Hour	Condition of Road	Length of Haul, Miles	Average Round-Trip Speed, Miles per Hour
Fair	.35	10	Spongy, rutted	1.80	18
Fair	.55	14	Good	2.40	27
Good	.95	21	Fair	2.60	21
Spongy, rutted	1.15	15	Good	2.80	28
Good	1.45	24	Fair	2.90	24
Very good	1.65	31			

direct loss on the main contractor, which loss frequently amounts to as much as 60 to 75c. per minute of mixer delay. The interest of the main contractor is therefore to have an oversupply of trucks sufficient to insure him against any delay from this source, while it is to the direct interest of the hauling contractor to supply only the average or slowest general rate of the mixer, so that all trucks can be maintained in constant operation at maximum capacity.

To reconcile fully these conflicting interests is difficult if not impossible. In portland-cement concrete a partial solution, which has been tried with apparent success by some contractors, provides for the hauling contractor to maintain only a truck supply sufficient to deliver the average hourly demand of the mixer for each particular daily haul, in addition to which the contractor provides sufficient trucks of his own to supply the additional demands of the mixer over and above the average. Under this plan the main contractor's trucks are brought on fully loaded as work begins in the morning. Then whenever the hauling contractor fails to have a truck ready as needed, the reserve trucks proceed to fill the gap to whatever extent may be necessary. These trucks also supply the last batches at closing time, noon and evening. A reserve of this kind in one- or two-batch trucks, equivalent to about 10 or 15 per cent of the hauling capacity supplied by the hauling contractor, would appear to merit much more study.

The foregoing discussion has been confined largely to haul for portland-cement concrete and bituminous concrete paving other than from central mixing plants or with transit mixers.

Plant-mixed batches

Open-body dump trucks are generally used to haul plant-mixed batches to the road. These are of two types, ordinary truck bodies without batch compartments such as are used in hauling loads of asphaltic concrete, and agitator bodies such as are frequently used in connection with central plant-mixed cement concrete. The chief advantage of this type of hauling equipment in conjunction with this method lies in the fact that the maximum capacity of the truck may be utilized by loading from a hopper having a stored excess of mixed batches. The size of the truck load is thus independent of the size of the mixed batch. At the plant the storage of pre-mixed batches is limited in both cases by the setting time of central-mixed cement concrete on the one hand and by the temperature requirements of central plant-mixed asphaltic concrete on the other. In the case of cement concrete, the use of pre-mixed batches is limited by specification as to the time after mixing and before deposit in such a manner as to restrict the field of operations to a definitely ascertainable haul distance. Furthermore, the capital investment in central plant mixing equipment is such as to relegate the use of this type of equipment to urban areas where a considerable volume of business is available.

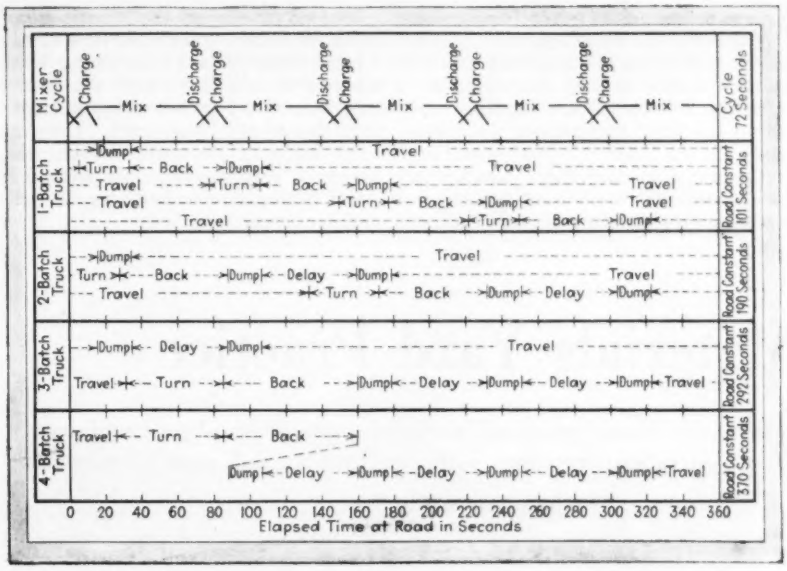

FIG. 7—AVERAGE TIME CONSTANTS at the placing point for several sizes of hauling units.

Centrally-mixed cement concrete is to a greater extent adapted to use in a metropolitan area surrounding a stationary plant set-up of considerable magnitude, and only to a minor extent to use on rural road construction; in the latter the degree of portability required lends itself to the portable batching plant and the traveling paver. In the case of asphaltic concrete, as has been heretofore indicated, the economy of this type of haul is most apparent.

Transit-mixed batches

Transit or truck mixers are used to load prepared batches of unmixed material at a central proportioning plant, to mix such material during the period of haul to the road, and arriving at the road to discharge the mixed batch for subsequent spreading and finishing. These units vary in size, capacity and cost. The larger units are quite expensive, and for average haul distances a considerable number is required to maintain accepted standards of production. Each unit is not only a truck but also a mixer. The truck functions practically full time but the mixer functions approximately half time—barring delays, which in some cases may reduce mixer operation to one-third of the working time. In returning empty from the road to the plant, the transit mixer functions exactly as an empty batch truck but costs considerably more, considering the original investment.

A PLANKED SUBGRADE saves hauling time and prevents a large amount of work filling ruts in a soft subgrade.

It is further evident that, from the standpoint of the larger initial investment, transit or truck mixers are also dependent upon an unusually large volume of business, such as will permit of almost constant year-round use. Such equipment has specialized use where large markets exist in urban areas, where the space available at the road or construction site is so limited as to prevent storage of materials, or where the use of a mixer or paver and batch trucks on the street would constitute a serious obstacle to the free passage of traffic. The use of transit mixing in connection with bridge and structure construction shows considerable promise of economy, primarily because of the increased ability to maneuver at the site of construction. Here, precision in spotting mixed loads and the ability to discharge small increments of the load at

various points are of great importance.

However, on rural highway pavement construction the operating characteristics of the hauling equipment are of primary importance. The time required to load the transit or truck mixer at the plant frequently exceeds the time for loading three batches in the conventional batch-truck hauling to a road paver. At the road the time required to discharge the transit-mixed batch frequently exceeds the time to mix a batch in a standard road paver. With comparable traveling speed the round-trip cycle of the transit mixer is longer than that of the batch truck. Thus, on rural highway pavement construction, except in special cases, this method is under a considerable handicap as compared with other methods.

Materials Yard Practice

Increased paving speeds call for precise integration of yard equipment and operating procedure with the hauling and paving operations

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THE PAST FIVE YEARS have witnessed an increasing tendency on the part of the highway contractor to study and analyze the operating characteristics and requirements of his plant and its various parts, to reach conclusions and to translate these conclusions into action. He has thus found that in most paving work the materials yard must be laid out, equipped and organized so that it will function effectively and efficiently not only as a materials yard but as an integral part of the entire paving plant. He has found, moreover, that in the performance of this function the materials yard plays an important rôle: First, it receives and unloads the incoming raw materials of stone, gravel, sand, cement, asphalt and filler as the case may be; second, it provides such stock piles and storage as may be required by the specifications or are necessary to iron out the fluctuations of the incoming supply so that the continuous demands of the mixer may be met, and, third, it combines these materials in specified proportions into definite quantities which are loaded into the hauling units, or else the incoming materials are fed more directly into the drier in specified proportions and at a given rate.

Mixer sets the pace

In either case the rate of final yard operation, or yard production, is found to be definitely fixed by the mixer. This production rate, as set by the mixer, cannot be exceeded except for relatively short intervals no matter how well the yard is equipped, organized or managed, nor can it be reduced without imposing a like decrease on the rate of total plant production. The mixer, whether for portland cement or for asphaltic concrete, is the key producer. Its maximum possible rate of production on any given job is definitely fixed by specification, operating and mechanical requirements. This maximum possible rate may be attained but it cannot be exceeded. Consequently any interruption or delay to any of the interdependent operations which exceeds the operating leeway, dependent on the amount of available storage between that particular operation and the mixer, automatically imposes a corresponding decrease on the production of the entire plant.

It is equally true that no single operation is ever so trivial or so insignificant that it cannot delay or hold up production just as effectively as though for the time it were the sole essential factor. Every piece of equipment, every group or assembly, must therefore be able to perform its required function with the regularity and within the limits set by the mixer; otherwise, a loss in production is the penalty. This applies with particular emphasis to the materials yard through which all the raw materials must pass. Hence it is essential that the materials yard be able to attain and maintain a rate of operation at least equal to and in close conformity with the production rate of the mixer.

The loss of a batch by the mixer because of slow operation at the yard one hour cannot be retrieved by faster yard operation the next hour. Every loss of production which any of the auxiliary operations or equipment units may impose on the mixer through any failure to sustain the required rate is therefore a loss beyond recall. The rate of yard operation as well as yard capacity must therefore be sufficient to supply the maximum or established rate set by the mixer.

Every auxiliary unit or group of units which form a definite step in the process of this type of pavement production must therefore have a capacity and rate of sustained operation at least equal to that of the mixer, otherwise this unit or this group becomes the pacemaker which determines the rate of production. This is usually fatal to any hoped-for profits. On the other hand, to provide equipment capacity much in excess of the attainable rate of mixer production is only a useless expense, except where and in so far as such excess capacity or rate affords insurance against probable mixer delays. Thus for example, bins of somewhat excess capacity tend to provide some surplus storage for bridging many of the various minor interruptions otherwise arising from such causes as crane trouble and delays incident to the shifting of cars, etc. Likewise a crane of somewhat excess capacity can readily keep the bins full and at the same time build up reserve storage sufficient to maintain steady production in spite of considerable fluctuations in the rate of material deliveries to the yard. Such reserve capacity should in general not be less than 10 per cent and need seldom exceed 20 per cent, except for the cement bin, which should really be large enough to hold enough for one full day's operation. Most cement bins are too small.

General principles

In selecting the site or location of the materials yard, chance sometimes offers an opportunity for an actual choice from two or more available sites or locations. Far more frequently it is only a question of how can the only available location best be adapted to the purpose in hand. Standardized layouts, at least so far as detail arrangements are concerned, are usually found impracticable, as each location nearly always differs materially from every other. Herein lies one of the main reasons why the yard layout deserves careful planning—though it usually receives little. This is regrettable, for while practically every yard layout is subject to many variations a few rather clear principles are found to be available as a guide to making the most of any given yard site. These may be stated as follows:

No materials yard set-up has made the most of the available site possibilities unless it can be shown that for the duration of the use of this set-up (1) the adopted layout and set-up can be relied upon to provide the hauling units or the drier, as the case may be, with a continuous supply of the desired materials in the amount and at the rate demanded by the mixer; (2) of all the possible yard arrangements the set-up as adopted will entail the least total outlay for all commitments resulting from or incidental to the cost of this set-up and its entire operation during the life of the job; (3) in the present yard set-up, such conditions of layout, arrangement or equipment use as have a tendency to impress time losses on or otherwise to increase the unit operating cost of other units of the paving plant may reasonably be expected to occasion a lower total cost to the contractor than would the operation of any other attainable yard arrangement and set-up.

The real object of the contractor is, of course, to complete the job of con-

structing the entire pavement at the lowest total cost. To attain this purpose each unit and each assembly group of units must contribute its proper share in forming an economical and efficiently functioning plant. The essential requirements are, that each unit and each group of units can be so adjusted as to function efficiently as part of the entire plant, and that the final organization of the various units be such that the total unit cost of laying the pavement is a minimum. Thus there can be no reason for a reduction of say 5c. per batch in handling the materials through the yard if such arrangement and set-up causes interruptions to the hauling units and subsequent mixer delays sufficient to increase these costs by say 10c. a batch. The criterion of the real worth of any unit, group of units or operation is therefore *its own cost plus the cost of its effect on the total cost of production.*

These principles should be kept clearly in mind in laying out and equipping every materials yard. They are not perfect, and perhaps also too general. But any definite general rules would appear to be inapplicable to conditions which vary so greatly from job to job. Each yard involves a different set of problems; their correct solution depends on ascertaining and interpreting the relative value of the local factors.

Planning the yard

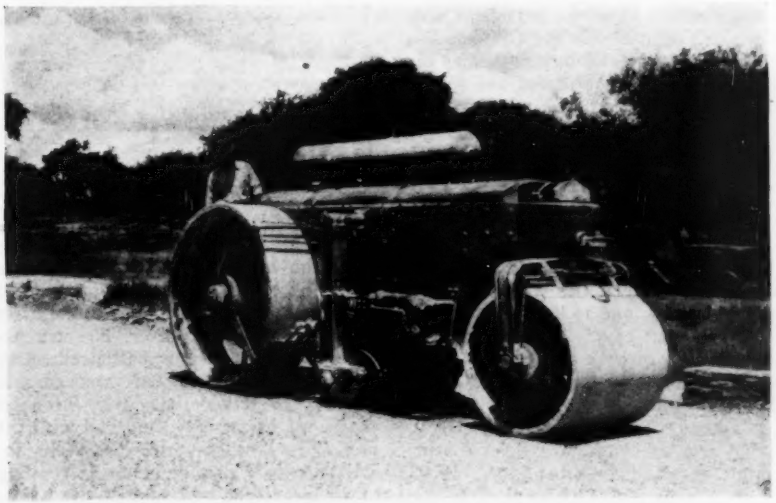
Many contractors are finding that to be of the greatest value the planning of the yard must begin with the preparation of the bid. Consequently, after the sources of materials have been ascertained the site or possible yard sites should be visited, and a sketch should be made showing or noting all of the controlling factors, such as boundaries, track and siding facilities, slopes, drainage features, ground or soil conditions, adjacent structures, road or street access, traffic and road conditions and distances to the job. Rental rates should be ascertained and, if it is the only available site, an option taken on its rental. Adjacent structures and the class of improvements should be carefully noted, as strenuous neighborhood objections are often made to the location of a materials yard, especially a bituminous plant, because of the attendant noise, dust and smoke. An hour or two spent by the successful bidder in an investigation of this kind will frequently forestall many days of later headache. Furthermore, the possession of this information is prerequisite to any real planning of the yard layout.

The actual arrangement of the yard set-up will vary with whether all or only a part of the stone, sand and cement or asphalt is to be obtained through rail shipment. Other controlling factors include the frequency and reliability of car deliveries, the number of separate sizes of materials required, the expected rate of production, the amount of stock-pile storage space available and whether one track or two adjacent tracks are available.

This second feature of the yard planning should also cover the adaptability of the particular site to the equipment on hand as compared with its adaptability to other obtainable equipment. For example, fast and efficient operation in handling bulk cement in buggies requires a platform long enough to permit working from two cars, and the adjoining truck drive must usually be depressed in a cut to obtain sufficient room for dumping the buggies onto the batch trucks. On the other hand, a bulk cement bin and batcher occupies much less ground space and can usually be placed at the most convenient location with regard to the route of the hauling units, since the pipe from the cement pump or the cement conveyor can be run either overhead or underground and thus always be out of the way. Where two adjacent side or spur tracks are available the first can then be given entirely to the aggregates; the cement cars on the second track simply require passing the cement pipe between the ties under the rails.

After having obtained the yard site and decided on the particular equipment to be used the next step is to determine the exact location and the arrangement of the various operations which are to be performed. In this work the planner must continuously keep in mind (1) that the operations within the materials yard are practically all of a repetitive character, many of which will be repeated thousands of times during the course of the job, and (2) that the yard must function as a unit for the single purpose of providing the drier or the hauling trucks, as the case may be, with

ELEVATOR GRADER with a shoulder finisher trims shoulders to profile and removes and loads surplus materials.



THIRD ROLL on the familiar road roller adds refinement of truer surfacing to crushed-stone roads.

a continuous supply of materials with the least possible delay to the trucks and at a rate fully equal to the demand of the mixer. This requires that the various units be adapted to working together and of ample capacity, and that every essential unit possess a high degree of mechanical dependability.

These two factors—adaptability to the particular work in question and a high degree of mechanical dependability—are very important. Adaptability to the work in question varies with the type of work to be performed. Thus, belt conveyors are frequently found both well adapted and very dependable in connection with the set-up of the asphalt paving plant but have seldom been adapted to loading the high aggregate bins used in portland cement concrete paving work. For this purpose the crane is still standard equipment. But to install a crane that is in poor condition or too small for the amount of materials to be handled is to break both of these rules at one blow. Such a piece of equipment is a liability from the moment it is brought on the job, never an asset.

More and more it is realized that all materials should pass through the yard with as little handling or disturbance as possible. Every additional movement whether in distance, elevation or in rehandling consumes time and energy and entails extra cost. This is one feature to which specification writers should give more heed. Frequently the requirements imposed as to the particular way in which the materials must be handled adds to yard congestion, necessitates the use of additional equipment and multiplies the difficulties of maintaining continuous and efficient operation.

Unloading crane practice

The first essential in yard operation is to keep the mixer going, and in portland cement concrete work a second essential is to keep the trucks moving and detain each one as little as possible. This is not an easy task. The modern paving plant often consumes raw materials at the rate of from 50 to 75 cu.yd. an hour. A crane equipped with a 1¼-cu.yd. bucket is usually used in portland cement concrete work to unload the incoming cars and feed the bins. If all the materials must first go into the stock piles instead of in part direct from car to bin, then some of the unloading will probably have to be done at night or after regular paving hours. If the yard layout is such as to require two loading bins with long moves between them, then two cranes will probably be necessary to maintain high production rates. In bituminous work a ¾-yard crane is frequently used in connection with the smaller plants while a 1½-yard crane is usually ample for the largest of present-day plants.

Where the sidetrack is considerably higher than the adjoining yard site one or more pits can sometimes be formed beneath and to the yard side of the track. The materials shipped in dump-bottom cars are then dumped into these pits. Such an arrangement saves some time as the crane can operate more continuously at its full production rate without the rate reduction which is attendant on cleaning out the bottom of a car and waiting while new cars are being spotted. Sometimes a belt conveyor also works well in this kind of a location.

A 1¼- or 1½-cu.yd. crane in good condition—and no crane not in good condition should be allowed on a paving job—is capable of maintaining a regular cycle of not to exceed 25 sec. when loading from stock pile to bin with a 90 deg. angle of swing. In loading from cars to bins the average cycle will generally be somewhat longer but should not exceed 30 sec. Where only one bin is used or where the two bins are so located as to require but little crane travel one crane should be able to maintain maximum mixer production. Where crane travel is long, and especially if all the materials must first pass through the stock piles, two cranes may be necessary. Table I shows the average rate of crane operation as found on a number of paving jobs equipped with 1¼-yd. cranes.

TABLE I—CRANE OPERATION, UNLOADING CARS TO BINS
Average Rates for Cranes in Good Condition and Equipped with 1¼-Cu.Yd. Bucket.

	Sand	Gravel or Stone
Load, seconds	7.8	8.3
Swing, seconds	8.0	8.4
Dump, seconds	2.2	2.1
Return, seconds	7.6	7.9
Total cycle, seconds	25.6	26.7
Average angle of swing, degrees	100	112
Average load per bucket, cu. yd.	0.88	0.76
Average net working time, per cent	68	67

Yard improvements indicated

At the bituminous paving plant the layout of the material yard is made to conform to the requirements of the main plant, the mixer and drier. The increasing use of preheated asphaltic cement or tar shipped in insulated tank cars is greatly reducing the many troubles otherwise frequently connected with the unloading of these materials. The increasing insistance on separate grading of the aggregate is, however, tending to accentuate the difficulty of obtaining sufficient room for the necessary stock piles without introducing the costly item of rehandling. As the number of required sizes of aggregate is increased the difficulty of maintaining a sufficient supply without rather large stock piles is multiplied. But stock piles require space, and when rains come the stock-piled materials usually have more moisture on reaching the drier than the same materials when coming direct from the railway cars. This increases and intensifies the already difficult problem of properly heating the aggregates.

The most general way of handling the aggregates is to unload them against a plank bulkhead just back of the cold elevator pit and then separate the several stock piles with wing partitions which project back from the bulkhead at the cold elevator pit in a sort of blunt apex in which the feed gates or feed hoppers are installed. A tunnel under the stock pile and a belt conveyor is sometimes used for the sand. The difficulty of securing a uniform feed from some sands when wet or partly wet still remains. A roomy tunnel or pit with a succession of manually operated gates feeding onto a belt conveyor appears to be fairly successful. For a sand which arches badly the pit or tunnel and gates must be so arranged as to permit frequent rodding.

It now seems probable that we shall eventually be able to develop an asphaltic plant in which the cold materials will be fully proportioned before they enter the drier. Perhaps some of the principles developed and the experience gained in connection with our present traveling bituminous road mixers may point the way to a practical solution. However, almost any workable method which would dispense with the present practice of hot screens, hot elevators and hot bins between the drier and the mixer would undoubtedly tend to reduce operating costs, decrease time losses and relieve the contractor from an almost endless source of worry.

In the materials yard for the concrete paving plant the most striking development has been the increased use of bulk cement and a more gradual replacement of the cement-loading platform and cement buggies by the loading bin and the pump or conveyor. To handle a batch of 600 lb. of cement with the buggy requires about 200 man-seconds.

To handle an equal batch with the bin and cement pump requires about 50 man-seconds. The bin and pump has also the further advantage of flexibility in that it lends itself more readily to such adjustment of the truck route as will conserve truck time and facilitate truck operation within the yard. The use of bag cement has greatly decreased recently.

In yard operation at asphaltic plants we find that the increasing use of preheated bitumens shipped in insulated tank cars facilities unloading. Asphaltic yard operations are also being greatly influenced by the recent developments in large capacity mixers and the slower but apparently growing tendency to install oversize driers, that is, driers having sufficient capacity to maintain full production when the aggregates are cold and full of water instead of only when dry or nearly so. These developments are forcing corresponding changes in yard layouts and methods of yard operation in order to insure that the greater and steadier demands of the mixer may be forthcoming as required. We may

TABLE II—EFFECT OF LAYOUT AND MANAGEMENT ON AVERAGE NET TIME REQUIRED TO PASS THE HAULING TRUCKS THROUGH THE MATERIALS YARD

	Size of Trucks			
	1-Batch	2-Batch	3-Batch	4-Batch
A. Good yard layout and able management:				
Load aggregate, seconds	10	38	70	98
Load cement, seconds	12	29	54	84
Drive and maneuver, within yard, seconds	48	65	87	62
Total net yard time, seconds	70	132	211	244
B. Poor yard layout and slack management:				
Load aggregate, seconds	33	91	163	196
Load cement, seconds	51	89	118	148
Drive and maneuver within yard, sec	210	218	193	132
Total net yard time, seconds	294	398	474	476

expect these movements to increase and become more general in the near future.

Efficient truck routing

In batching the aggregates the most striking changes are the general adoption of the weighing batcher and the more gradual tendency toward the use of larger bins. The actual time of completing the operations involved in passing the batch trucks through the yard does not appear to have changed materially. These operations are still greatly influenced by the yard arrangement and the efficiency of the management.

Table II illustrates the effect which management and yard layout has on the time required for passing the batch trucks through the yard. The first section shows the average time required for each of the individual operations as determined from 12 different well-laid-out and efficiently-managed jobs, three of each using one, two, three and four batch trucks. The second section shows the same items for 12 fairly similar jobs except that the yard layout and yard arrangement were poor and the management inefficient.

Most of these time increases are easily explained. Every maneuver or operation within the yard requires time. Poor layout and inefficient management form an especially voracious time consuming combination. The yard layout and arrangement must therefore, insofar as possible, provide for straight-line operation. The ideal arrangement is a layout which permits the trucks to enter the yard on an easy curve, drive straight through each of the bins and then out on another easy curve. The total driving distance should be short and the road should be maintained in good condition. Where two sizes of coarse aggregate are used the bin should have three compartments so as to require only one stop for receiving all the aggregates. If three splits are required in the coarse aggregate then two bins must be used and frequently also two cranes.

For a yard layout which requires the batch trucks to back under the bins we find that to make the customary 90 deg. turn and back under the bins usually requires from 20 to 30 sec. To make a 180 deg. turn and back under the bin usually requires from two to three times as long, depending on the width and condition of the available turning space. With good batching facilities the standing time of the truck for taking on the first batch of aggregate need not exceed 10 sec., as the batcher can be loaded and weighed while the truck is driving in. For each additional batch an interval of from 20 to 40 sec. will have to be added, depending largely on how readily the sand flows and how alert the driver is.

Where two aggregate bins are used these figures are simply repeated, as it requires practically the same amount of time at a bin to take on a partial batch as a full batch. At the cement bin the first batch can be dumped in about 10 to 12 sec., about 25 sec. is required for taking on each additional batch.

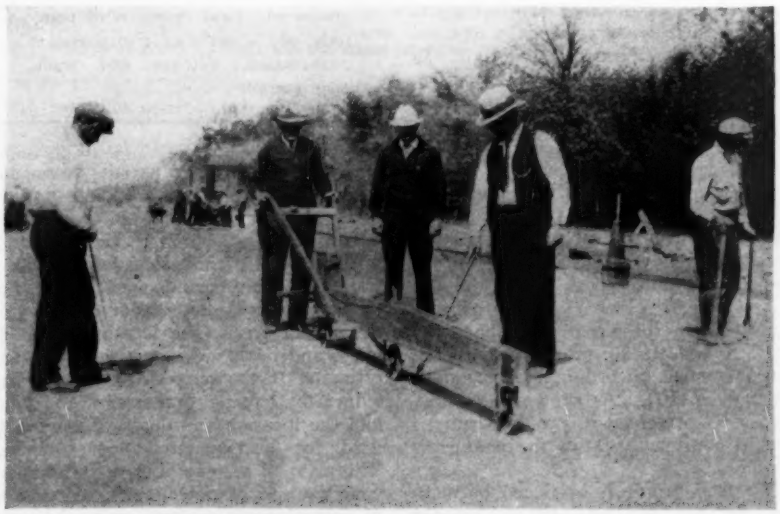
In asphaltic work, when an ample gob box is used, the full load can usually be taken on in about 20 sec. In cool weather spreading the canvas cover consumes about another 20 sec., while the weighing can generally be done in from 20 to 30 sec. The drive between the gob box and the scales is usually short. Consequently the time which the hauling vehicles are necessarily detained at such a yard need not exceed 75 sec. under favorable conditions, and the layout should never be such as to require more than 2 min. for the necessary yard operations in taking on a load and passing through the yard. If no gob box is used the loading time will vary with the length of the mixer cycle and the number of batches carried per load. The use of a gob box thus not only saves much valuable truck time but also tends to reduce mixer delays.

Summary

In summary, while a good many changes may be noted in the materials yard of today as compared with the yard of five years ago, these changes are mostly the result of a rather gradual development. Some, such as the general adoption of the weighing batcher, have at least in part been forced on the contractor by changes in specification requirements.

Others, such as the bulk-cement bin and cement pump or conveyor, have their origin largely in the price differential in favor of bulk over bag cement. The crane still remains the standard piece of equipment for unloading the aggregates from railroad cars, though we shall probably see more use made of the belt conveyor in the future.

Methods of yard operation, however, have undergone very little change. Managerial ability also remains as important as ever, whether it be expressed in obtaining a good yard layout, in securing an economical set-up or in maintaining efficient yard operation. The progressively increasing recognition and effective application of these principles by our highway builders during the past five years will continue. This definite trend offers the most promising present prospect from and through which we may confidently look for future advances in the art of building greater safety, better adaptability, longer life and greater economy into our highway systems.



PROFILOMETER TEST before filling keeps the modern brick surface accurately to profile.

Preconstruction Aids

Careful preparatory studies

insure design accuracy and construction economy

JOHN O. MORTON
Soils Engineer, New Hampshire Highway Dept., Concord, N. H.

WITH his demands for better pavement structure and closer supervision of construction, which require planned management, the road engineer has provided preconstruction helps. This conception of the obligations of highway engineering in construction has been greatly advanced in the last five years.

The modern survey for construction goes far beyond the requirements of a few years ago; besides route selection for traffic service and economic development all road surveys involve studies pointed directly or indirectly to presenting and solving construction problems. The kind and number of these special survey services have widened in scope from the old railway practice of giving work items and quantities, character and classification of excavation, cut-and-fill balances, economic haul and overhaul, and general information. They now extend to specific determinations of rock character and stratification in cuts, slip and subsidence possibilities, fill shrinkage and swell, soil surveys to determine replacement or treatment of unstable subgrades and local desposits of materials, and a study of transportation construction, detours and traffic maintenance.

PRECONSTRUCTION studies for roadbuilding have been greatly extended in recent practice. The new developments head up principally into soil and materials surveys, surveys for traffic-maintenence detours and a field check of prepared plans with actual ground conditions. While these studies are directed perhaps primarily to securing information for an accurate and an economical highway design, they are an assurance to the contractor of definite construction conditions and an unchanged structure for which he can plan and estimate cost with accuracy.

As stated, studies for design and construction purposes, besides the usual computations of itemized quantities, cut and fill, borrow and overhaul, have developed recently along four lines: (1) soil surveys, (2) material surveys, (3) field check survey, and (4) traffic maintenance and detour surveys. These four operations will be considered in order as to methods, presentation of information and application of results. To keep within reasonable space, condensation has been drastic, and charted information has been employed to supplement the text.

Soil surveys

Under the direction of a soils engineer, soil mechanics is applied to highway engineering by means of the soil survey, which in its complete form represents a series of studies aimed at identifying and solving variables presented by natural foundation conditions and materials. In scope the survey covers the location, classification, condition, action and quantity of the following materials: (1) natural subsoils, (2) swamp areas, (3) solid ledge and boulder ledge areas, (4) top soils, and (5) previous road-construction materials. The presentation and application of soil survey data are accomplished by means of a soil profile and a soil-profile report.

Soil Profile—Two examples of portions from a soil profile are shown by Figs. 8 and 9; all profile graphs are given symbols according to a standard chart (Fig. 10). As shown, the information is presented in profile form for use in conjunction with the engineer's profile.

The soil profile is produced by making borings and test pits along the project at sufficiently close intervals and to a depth that permits accurate knowledge to be obtained about the materials that will be moved or affected during the construction period. On this profile is plotted and recorded the location, classification and condition of the natural subsoil; the extent and depth of swamp areas; the location of solid ledge and boulder ledge areas, with an estimate of the percentage of boulder ledge; the location and type of top soil, and the location and depth of materials used for previous road construction. This method of recording permits other conditions to be noted, such as location of natural water pockets, surface drainage conditions and location of sidehill areas. Attention is thus called to the advisability of raising or lowering the grade.

The soil classification presented by the soil profile involves a method of placing material into different groups, each group representing a different soil characteristic capable of a definite mechanical action. It provides a means of identifying such factors as stability, drainage properties, capillary properties, ability to shrink, swell, slip, subside or produce frost action.

Soil profile report

A report accompanying the graph (Figs. 8 and 9) amplifies the data on natural foundation conditions and covers phases of design and construction not presented on the profile. Under the following headings, it covers and consolidates a wide range of vital construction information:

1. Present Road Surface—A history of the old road surface is presented, including its character and condition and the materials used for its construction. The study of the old road is made in cooperation with the local maintenance man so as to secure precise information relative to seasonal breakups, location of weak points in the subgrade and surface-drainage conditions. Such knowledge permits checking of the weak points in the subgrade against the soil profile; it correlates soil profile data with actual field conditions.

2. Subsoil Conditions—A description of natural soil conditions and character of excavation is presented. It points out whether the material is loosely deposited or very compact, cohesionless, cemented or plastic; wet or dry; likely to shrink, swell, slip, subside or produce frost action.

3. Swamp Areas—Location and depth of swamp areas are accompanied by information as to whether or not the material is a peat or muck. The stability of the material is noted, and methods of constructing the road over such areas are suggested.

4. Ledge Areas—The location of solid ledge is given by stations; areas of boulder ledge are located, and an estimate is made of the percentage of boulder ledge that will be encountered by excavation through these sections. Information on the character of ledge is recorded.

5. Topsoils—The condition and location of topsoil material is noted, and recommendations are made as to the desirability of removing these materials when encountered in light fill sections.

6. Alignment of Roadway—Often the soil profile will bring to light conditions that predict costly construction or maintenance items on the proposed line; a description of these conditions with a suggested line change and reasons is recorded.

7. Grade Recommendations—Conditions are pointed out that permit the establishment of a grade with regard to the condition and type of the natural subsoil; recommendations are made to avoid heavy cuts through ledge sections; attention is called to the dangers of construction at low elevations over wet areas, and heavy cuts with the side slopes moved back may be suggested to take advantage of good natural foundation materials.

8. Foundations and Underdrains—Recommendations are made regarding the amounts of base course necessary to meet variables presented by the natural subsoil; underdrains are located; attention is called to conditions where construction of the base course in thin layers will result in such mixing with the natural subsoil that the value of the base course is lost. Methods of construction are suggested to remedy such conditions.

9. Remarks—Attention is called to any unusual condition not covered in other sections of the report. Seasonal variations affect construction methods and upset design plans. Certain types of soils (silts and graded materials), if moved during periods of seasonal rains, may become highly unstable; construction with the same material in dry seasons offers no unusual difficulty. Knowledge of these facts permits work to be performed during favorable seasons.

Application of Information—Specific utilization of these soil-survey data is no more important, however, than the service it renders in developing new trends of practice and in opening fields of thought that are important advances in highway engineering. One of the simplest of these is replacement of a uniform base course by a varied design, which would result in over and under design in different subsoils. Advantage is taken of good natural foundation materials; the weak points in the subgrade are corrected by the proper use of varying amounts of sub-base materials and the correct location of underdrains.

Again, a common fallacy of the past has been the attempt to design so that cut and fill sections balance. Today, the desirability of such a procedure is dependent upon foundation conditions pointed out by the soil survey; in some cases the soil survey indicates that excavation will be into dangerous materials, and balanced quantities should be avoided.

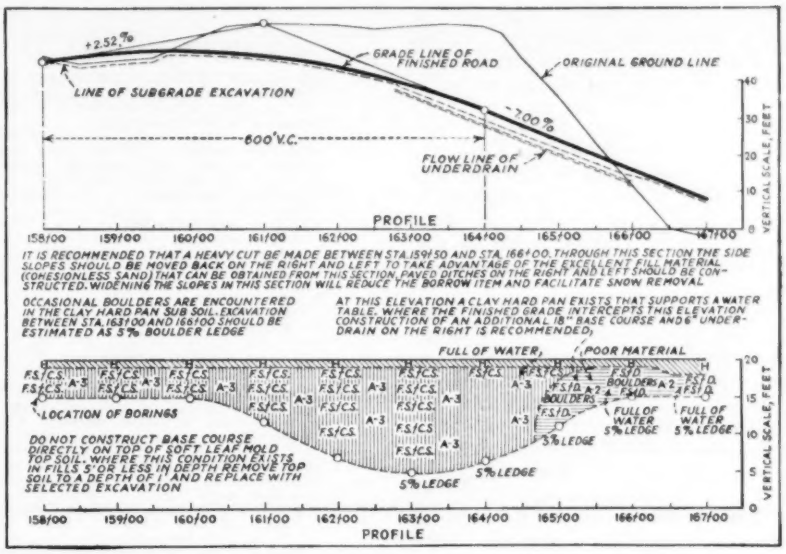

+2.52%
GRADE LINE OF FINISHED ROAD
ORIGINAL GROUND LINE
LINE OF SUBGRADE EXCAVATION
-7.00%
600' V.C.
FLOW LINE OF UNDERDRAIN
PROFILE
158/00 159/00 160/00 161/00 162/00 163/00 164/00 165/00 166/00 167/00
VERTICAL SCALE, FEET
IT IS RECOMMENDED THAT A HEAVY CUT BE MADE BETWEEN STA. 159+50 AND STA. 166+00. THROUGH THIS SECTION THE SIDE SLOPES SHOULD BE MOVED BACK ON THE RIGHT AND LEFT TO TAKE ADVANTAGE OF THE EXCELLENT FILL MATERIAL (COHESIONLESS SAND) THAT CAN BE OBTAINED FROM THIS SECTION. PAVED DITCHES ON THE RIGHT AND LEFT SHOULD BE CONSTRUCTED. WIDENING THE SLOPES IN THIS SECTION WILL REDUCE THE BORROW ITEM AND FACILITATE SNOW REMOVAL
OCCASIONAL BOULDERS ARE ENCOUNTERED IN THE CLAY HARD PAN SUB SOIL. EXCAVATION BETWEEN STA. 163+00 AND 168+00 SHOULD BE ESTIMATED AS 5% BOULDER LEDGE
AT THIS ELEVATION A CLAY HARD PAN EXISTS THAT SUPPORTS A WATER TABLE. WHERE THE FINISHED GRADE INTERCEPTS THIS ELEVATION CONSTRUCTION OF AN ADDITIONAL 18" BASE COURSE AND 6" UNDERDRAIN ON THE RIGHT IS RECOMMENDED.
FULL OF WATER, POOR MATERIAL
LOCATION OF BORINGS
DO NOT CONSTRUCT BASE COURSE DIRECTLY ON TOP OF SOFT LEAF MOLD TOP SOIL. WHERE THIS CONDITION EXISTS IN FILLS 5' OR LESS IN DEPTH REMOVE TOP SOIL TO A DEPTH OF 1' AND REPLACE WITH SELECTED EXCAVATION
5% LEDGE
3% LEDGE
FULL OF WATER 5% LEDGE
PROFILE

FIG. 8—SECTION OF ROAD PROFILE in cut on hill with a soil profile, showing the character of materials in the cut and giving directions for excavation and drainage.

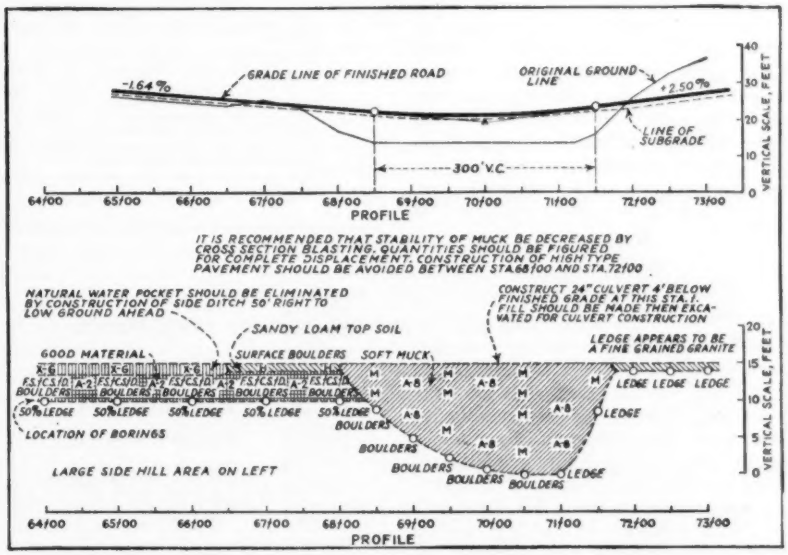

-1.64%
GRADE LINE OF FINISHED ROAD
ORIGINAL GROUND LINE
+2.50%
LINE OF SUBGRADE
300' V.C.
64/00 65/00 66/00 67/00 68/00 69/00 70/00 71/00 72/00 73/00
PROFILE
VERTICAL SCALE, FEET
IT IS RECOMMENDED THAT STABILITY OF MUCK BE DECREASED BY CROSS SECTION BLASTING. QUANTITIES SHOULD BE FIGURED FOR COMPLETE DISPLACEMENT. CONSTRUCTION OF HIGH TYPE PAVEMENT SHOULD BE AVOIDED BETWEEN STA. 68/00 AND STA. 72/00
NATURAL WATER POCKET SHOULD BE ELIMINATED BY CONSTRUCTION OF SIDE DITCH 50' RIGHT TO LOW GROUND AHEAD
CONSTRUCT 24" CULVERT 4' BELOW FINISHED GRADE AT THIS STA. FILL SHOULD BE MADE THEN EXCAVATED FOR CULVERT CONSTRUCTION
SANDY LOAM TOP SOIL
GOOD MATERIAL
SURFACE BOULDERS
SOFT MUCK
LEDGE APPEARS TO BE A FINE GRAINED GRANITE
LEDGE
50% LEDGE
LOCATION OF BORINGS
LARGE SIDE HILL AREA ON LEFT

FIG. 9—SECTION OF ROAD PROFILE at a dip with a soil profile, showing the unstable character of the material and giving directions for handling the muck pocket.

Knowledge of soil action permits the design to be made with due regard to soil shrinkage and swell possibilities. Cemented or compacted soils and ledge rock swell upon being excavated; loosely deposited materials and soils high in water content cause shrinkage in fills. Determination of the shrinkage factor is dependent on this information. Previously, underdrains have been constructed without regard to soil types; silt and clay soils have high capillary properties, and drains constructed in these materials have but small value or may even prove detrimental. The soil survey recommends the construction of underdrains in sections where they will be effective.

Knowledge of swamp-area conditions has enabled the engineer to develop various means of solving these problems. Complete excavation of the material, displacement by blasting, loading the swamp area before the use of explosives, reducing the stability by the addition of water in sufficient quantities to cause the material to flow, are suggested solutions of such problems. The selection of a method of procedure that will be successful and allow an accurate estimate to be made of the quantity of materials involved is made available by the soil survey.

Studies of the character and stratification of ledge presented by the soil survey have served to place new value on design and construction methods through these areas. The safety of

slopes in ledge cuts is dependent on the structure and weathering qualities of the material. Stratification affects excavation costs and the suitability of the material for fill sections.

Loosely-deposited materials, fine-grained soils or cohesionless sands may scour in ditches; cuts in materials subject to frost action will cause slopes to slide. The proper location of paved ditches and the correct design of side slopes are factors dependent on the soil survey.

Soil surveys have served to predict the need of future studies as a means of solving construction problems presented by natural foundation conditions. Underdrains, insulating materials and the treatment of natural subsoils with bituminous and chemical materials are various methods of combating frost action or increasing soil stability in need of future development. How to prevent base-course materials from mixing with natural subsoils and how to construct fills properly are problems to which the engineer must direct more attention in the future.

The application of soil mechanics knowledge provides a means of solving the highway engineer's foundation construction problems. The survey should not be expected to gurantee all natural soil conditions, but it offers to the engineer a much higher degree of information and indicates conditions with more accuracy than any previous method employed.

Materials survey

From the preceding analysis of methods and uses it will be seen that the soil survey gives new importance to the use of local materials in construction. Because of his familiarity with local conditions, it becomes a logical part of the soils engineer's duties to furnish information concerning such materials by a materials survey. This consists of locating, classifying and evaluating local deposits by means of test pits, from which samples are taken for laboratory evaluation of quality and grading. The engineer's knowledge of ground formations and general conditions, together with the familiarity of the maintenance man with local deposits, provides a means of locating materials.

The materials survey report furnishes the following information: (1) the location of local borrow materials such as earth, gravel, sand, loam, rock and a recorded description and estimate of the quantity available, together with transportation conditions to the project; (2) a study of the availability of local base-course materials such as gravel, stone or sand; (3) the locations of commercial plants and railroad facilities are given in relation to local pavement materials such as concrete aggregate, broken stone, surfacing gravel, crushed gravel, etc.

SOIL PROFILE LEGEND

X = fill material. (It denotes that the material does not occur naturally in this position. This material has been used for road construction of previous years.)
H = top soil. (Top soils are designated separately because of the fact that they contain organic and vegetable matter. Generally the top soil is very similar in mechanical composition to the material below it.)
V.F.S. = very fine sand
F.S. = fine sand
C.S. = coarse sand
G. = gravel
D. = silt and clay
M. = muck
B. = boulders
L. = ledge

GROUP CLASSIFICATION

A-2 = a graded material containing binder (silt and clay) in varying amounts and capable of frost action in varying degrees. The amount of frost action is a direct function of (1) the elevation of the groundwater table and (2) the silt and clay content of the material. This group is subdivided into three parts.
First = *A-2*. Good material—low in silt and clay content, capable of about 2-in. heaving.
Second = *A-2*. Fair material—medium silt and clay content, capable of about 4-in. heaving.
Third = *A-2*. Poor material—high silt and clay content, capable of about 6-in. heaving.
Such materials as hardpans, glacial till and ordinary earths fall into this classification.
A-3 = cohesionless materials, represented by sands and gravels. Such materials are free from frost action and offer excellent support for rigid pavements.
A-4 = silt and clay of high capillary action and high frost action (8-12-in. heaving.) Uniform frost action each year regardless of elevation of groundwater table.
A-8 = muck. High vegetable content, highly unstable.

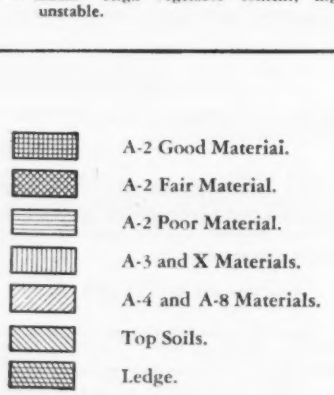


FIG. 10—STANDARD SYMBOLS for soil-profile graphs enable rapid reading and precise interpretation of the information presented.

Application of these data has been responsible for new trends and economies in highway design. Borrow areas adjacent to the project may supply material superior to the excavated material and at lower cost; this permits the engineer to unbalance the job and take advantage of the higher type material.

Often in the past, a contractor has been forced to gamble on the possibility of finding suitable local material and to bid high enough to cover such hazards. However, if he is supplied with positive information, the savings are passed directly on to the state.

The combination of a soil survey and a materials survey has enabled the engineer to design the road efficiently, taking into consideration the materials available for construction purposes and the economic haul and overhaul of such materials. When necessary, directions concerning the placing of materials are incorporated in the plans on a section basis, with limits specified in regard to elevation. Under such conditions the overhaul item can be avoided, for the contractor has the necessary information to figure the cost of such work accurately.

Field check and detour survey

When tentative plans have been drawn to include grade quantities, an inspection check is made by the construction or field engineers or their assistants. In scope, the field inspection survey consists of checking against actual field conditions the alignment and grade, the location of surface drainage and other structures, the location and type of guard-rail, and the determination of waste and spoil areas. Application of the field inspection survey results in a more accurate and complete design and eliminates the necessity for any major changes during the construction period.

The traffic maintenance and detour survey may be carried out by the personnel employed on the field-inspection survey. In scope, it covers a study of the economic problem involved and the location and condition of detours available.

The information obtained from this study is presented to the engineer in the form of a map and a report showing the location of the detour in reference to the project and describing the length, width, condition and type of surface. It also includes an estimate of the traffic to be carried by the detour, a description of business places located on the project and an estimate of the costs involved.

The following factors favor the use of detours: Maintenance of traffic while construction is in progress forms a real hazard to the contractor. Present-day equipment requires freedom of movement to produce the efficiency required of it. Inefficient manipulation of equipment, the use of extra materials for dust preventatives (calcium chloride and bituminous treatments) are expensive. Base-course materials under traffic may become mixed with the natural subsoil, necessitating special design. The public is subjected to delays and additional dangers.

On the other side of the account are these considerations: A suitable detour must be available. Places of business along the construction may suffer by removing the traffic upon which they depend for a livelihood. The cost to the public arising from detour distance may offset the costs chargeable to traffic maintenance.

The trend today is definitely in favor of the detour.

Conclusion

The increased scope of preconstruction surveys has enabled the engineer to attain new heights in accuracy of design and economy. At the same time, a better understanding has resulted between contractor and owner. Confidence on the part of the contractor in the ability of the engineer to design accurately is invaluable; it means that quantities upon which he has bid will not be changed during the construction period, and that his prices can be figured accordingly.

The trend in highway engineering today is toward incorporating in the design and the call for bids enough detail information to provide a complete picture of the conditions encountered on the project, together with a knowledge of the materials available for the work. This serves to place a premium on the efficiency of the contractor's organization rather than on his ability to guess conditions. Better and cheaper construction is the result.

Extended Supervision

Defined by

H. K. Bishop, C. M. Hathaway, O. L. Kipp, H. S. Mattimore and E. D. Parker

DIRECT or indirect supervision of road construction is vested in an imposing array of agencies. Some of these are of long standing and others are of recent influence, but all of them have a hand in governing construction and all have increased their dominance over recent operations. This begins with the terms of contract and extends down through federal, state and laboratory to the contractor who must alter and elaborate his job-control organization to meet improved demands.

Most of the new restrictions and particularly those relating to labor relations and restrictions on machine processes are set up to meet depression conditions of unemployment and will be abandoned as employment becomes normal. In the construction immediately in prospect emergency-dictated practices will prevail; in construction to come later under normal financing some of these practices will be carried over. But regardless of this possibility, increased supervision of construction is demanded by the higher structural standards that have been set up for pavements. One source of increasing control will be the laboratory.

In the technique of construction the laboratory is certain to play a controlling part in addition to its routine function of detection. An indication of this wider function is given by the soil survey, but the work of the laboratory in a supervisory capacity will extend to specification writing, studies of defects and failures, control of purchases and other activities. The designer and constructor is coming to have an exacting master as well as a capable servant in the roads laboratory.

These brief conclusions are brought out in sharp perspective by the group of four articles that follow. Each is written by an engineer working directly in the field of supervision that he discusses.

Labor Relations Standards

Consideration for the welfare of the workman has introduced new contract requirements for pay, working hours and safety and for equipment use and time limitations

O. L. KIPP
Construction Engineer, Minnesota Highway Department, St. Paul, Minn.

THE CONTRACT, including plans and specifications, is the documented agreement of the contractor to perform stipulated acts at a price and of the contracting authority to pay that price on performance. Of necessity there must be precision and rigidity in the terms of such an agreement, but the spirit controlling its objectives can be humanized.

To state the present situation succinctly: Although there has been very little alteration in the essential and legal framework comprising a fair and equitable covenant or contract involving general highway and bridge construction, there is a marked change evident in the requiremnts governing the execution of the contract. No longer does the party of the first part merely require solely a definite accomplishment in the combination of labor and materials according to specified workmanship and standards of quality; added to the customary specifications there are now social factors not formerly considered.

Influenced by depression

These changes have been introduced by emergency construction to give employment; factors relating to the welfare of the workman, the standard of wages and the man-hours of employment are as definitely specified as are workmanship, materials, dimensions and time of completion. Curtailment of Sunday and holiday work and definite safety measures for the workman and the public are now commonplace; the emphasis on man-days of employment alters the time element of a contract to a specified total of working days instead of an arbitrary calendar date of completion; so-called stage construction is encouraged; state lines influencing the qualifications of bidders are largely obsolete; penalizing large labor-saving equipment to provide a certain amount of man-hours of labor is general.

To meet these social needs of unemployment it may well be the policy to provide many small contracts widely distributed. As long as highway construction and improvement is geared to the human problem of living rather than to the movement of population as represented by actual traffic needs, we must

expect to have arbitrary employment provisions dominating the execution of contracts.

The old institution of the general contractor, an organization skilled in the selling of subcontracts and in supervising their related activites for a definite differential of profit, was and to a certain extent still is a necessary development in the building of large railway and hydraulic projects. However, the opposite trend is evident in the policies governing the planning and administration of highway construction programs; here it will usually be compulsory for the contractor actually to execute the major part of the construction.

No doubt many uneconomic requirements now in vogue on federally financed projects will be modified as the unemployment and social needs become less poignant. Emphasis on hand-labor methods is already disappearing. An incentive for more efficient and economical methods of construction is vital to the continuance of a competitive construction business; contractual requirements having a definite load of social obligations in wages and conditions of employment must be offset by improved and cheaper means of doing the major work operations.

Reducing the corpulent proportions of the special provisions and limitations of the present contracts will be a natural dieting process; it will be only as rapid as is the reduction in the number of agencies now represented by the "party of the first part."

Out of the welter and confusion and the present necessary dominance of the clerk and the adding machine rather than the builder, out of the alphabetical headaches, may be distilled for future use a more simple, clearcut instrument binding the parties of the first and second parts to a definite payment for the building of a definite public improvement constructed in a definite manner. However, the "manner" of the execution of the contract of the future will be permanently colored with a new tone not found in the terms of the contract of a decade ago; it will be the earthy pigment of a human character incorporated in the structure of the contract itself providing for definite safeguards relating to the welfare and social security of the workman as well as for the quality standards of the materials and workmanship.

Role of Federal Authority

Directional supervision by the Bureau of Public Roads on work involving federal expenditures remains largely unchanged except for relief work

H. K. BISHOP
Chief, Division of Construction, Bureau of Public Roads, Washington, D. C.

SINCE the passage in 1916 of the first act providing for federal aid to the states in highway construction in the United States, the Bureau of Public Roads, under the direction of the Secretary of Agriculture, has been responsible for the administration of all highway construction in which federal funds are invested. Until 1930 the greater part of these investments took the form of federal grants which, matched by state funds in approximately equal amounts, were expended for the construction of federal-aid roads. Smaller sums were invested in the construction of roads in the national forests, national parks and other federal reservations and public lands. Respecting the first and larger form of investment, the bureau has shared the responsibility of direction with the state highway departments; in the second and less extensive operations, wholly federal in character, it has acted as the sole supervisory agency.

During the period of the depression these long-sustained, normal operations have been overshadowed by the emergency construction instituted to increase employment, a work which, though wholly financed by the federal government, has been administered jointly by the state highway departments and the Bureau of Public Roads.

On the work jointly administered, the law assigns to the state authority the duties of initiation and immediate supervision; to the federal authority it gives the power of approval and the function of coordination. The cooperation thus required has been the determining factor in shaping the organization and policies of the Bureau of Public Roads.

Control procedure

Intimate contact with the state departments is established by the creation of a district field organization, which has grown with the magnitude of operations and—long maintained without disturbance—given the bureau a familiarity with local conditions not less complete than that of the respective state authorities. As now developed this organization consists of twelve district forces to deal with cooperative operations in the United States proper. An additional district administers forest road work in Alaska, and another supervises forest and park road work in the eastern states. In each state one or more engineer representatives of the district engineer serve as the immediate contacts with the state highway department.

From the state representative the line of authority passes to the district engineer and thence, in the east, to the Washington headquarters; in the west administrative delays are avoided by the interposition of a regional headquarters staff, headed by the deputy chief engineer at San Francisco.

Each state highway department must submit to the bureau detailed programs of proposed construction projects for the utilization of funds apportioned to the state under provisions of acts of congress. After approval of the program by federal officials the state must then submit project statements covering individual projects within the program. This is followed by the submission of

TRAVELING BITUMINOUS PAVER picks aggregate from windrows, impregnates it and drops it on subgrade for finishing machine to spread and make smooth.

complete plans, specifications and estimates. Delays in getting projects under construction are avoided by authorizing the states to let contracts and begin construction upon approval of the state proposals by the district engineer, but all plans and specifications are finally reviewed in the headquarters office. Construction work is advertised and award made by the state to the lowest responsible bidder according to a standardized procedure designed to insure free and open competition; prequalification of bidders has been consistently advocated by the bureau for a number of years.

In constructing roads in national forests and parks, and in certain other classes of work not involving state cooperation, the bureau discharges all engineering and administrative functions.

On work involving state cooperation detailed supervision of construction is furnished by the state highway departments with coordinate supervision by engineers of the bureau. Inspections are made by bureau engineers at least twice each month. As the work progresses payments are made by the federal government to the state for work satisfactorily completed.

When a state has difficulty in meeting current obligations to contractors on projects involving federal funds, advances may be made to a revolving fund. Such revolving funds must be handled according to strict requirements designed to insure proper handling. Excepting advances to these funds, payments are made only for completed work.

On completion of a project a final inspection of all details is carefully made and if the result is satisfactory, a recommendation is made to Washington that final payment be made. Thereupon a general review is made of the engineering and fiscal history. When all matters are in order, final payment is made.

However, this does not end the bureau's interest in the road in question, for the state or other unit of government is pledged to maintain the road properly. Periodic inspections are therefore made to insure that the federal investment is conserved.

Laboratory Guidance

Detection is only one function of the highway laboratory, which now enters many fields of advisory supervision and often fields of broad research

H. S. MATTIMORE
Engineer of Tests, Pennsylvania Department of Highways, Harrisburg, Pa.

PERHAPS the best way to indicate the kind of supervision that the roadbuilder may expect from the laboratory will be to outline the purposes and functions of an adequate laboratory. Such laboratories now exist and more of them will be developed as roadbuilding increases.

A state testing laboratory is a consultant in supervision to other divisions of the highway organization on material qualities and the fabrication of such materials as concrete and bituminous mixes. The actual routine testing of materials is an important function, and one on which the organization is based, but the modern laboratory has been broadened so as to include many other functions; in fact state laboratories that confine their efforts entirely to routine testing limit their scope and their value to the main organization. Some of the functions of a modern highway laboratory, exclusive of routine testing, are:

1. Supervision of material sampling and field control of materials actually used.

2. Preparation of material specifications, including fabrication of materials such as concrete and bituminous mixes.

3. Evaluation of materials and types of pavements promoted for use by the department.

4. Investigation of defects and failures in structures where they relate in any way to materials or fabrication.

5. Guiding material producers in quality production, especially in natural products.

6. Quality control of departmental purchases including not only construction materials but others such as gasoline, oils, small tools, etc.

7. Advising other bureaus relative to new operations, new materials, and new types of pavements developed by other organizations.

8. Keeping in close contact with all technical societies that study and standardize construction and operating materials which might be used in departmental work.

Field Tests and Inspection—One of the operations which is now well established as an adjunct to the testing division is materials control in the field. No highway department can be fully assured of the quality of the materials used unless this control is centralized; centralized control is absolutely essential for success on materials work.

The interpretation of specifications and detailed field testing must be standardized throughout the entire department, otherwise there is no assurance that material qualities will be the same in all divisions and sections, and when such conditions do not exist contracts cannot be let on an equitable basis and material producers cannot compete in different sections of the state on the same basis. This should not be interpreted to mean that all field operations pertaining to materials are performed by the personnel of the materials division, but that this division may guide and supervise such work whether or not it has direct control.

New Types of Pavement—At times various interests wish to present materials to a state highway department for use; the evaluation of such materials many times presents difficult problems. Even if only the materials that seem to have merit were subjected to exhaustive research a state highway department would require a large well-trained technical personnel engaged full time, but an arbitrary refusal to consider new materials or methods may prove to be a lost opportunity. One remedy is to insist that the producer or designer who pre-

SIDEWALKS are still infrequent but are certain to make a growing demand on the roadbuilders' organization and equipment service.

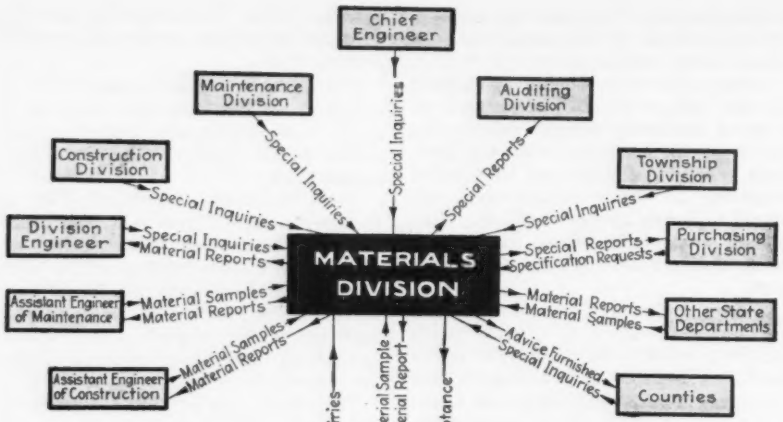


FIG. 11—RELATION of materials division of the Pennsylvania department to other divisions and to other departments of the state and counties.

they give producers an unfavorable impression of the entire highway personnel.

Control of Purchases—Many people think of a highway department as a supervising agency which controls construction performed by other agencies; actually the modern highway department has a large operating division for maintenance. Large volumes of materials are purchased for use by this division, exclusive of construction materials, such as gasoline, oils, paints, small tools, etc. Proper control of these materials requires efficient specifications and a well trained testing organization. Plant control, where this can be economically carried on, is an economic procedure for both the producer and the department.

Advisory Functions—New materials and methods in highway construction are constantly developing; the laboratory, with proper personnel, keeps in close contact with such work. This means that inspections are made in other states either during or after construction, and reports furnished relative to the efficiency of such operations or materials. This results in avoiding the use of materials or methods which have been found unsatisfactory, or in adopting processes which have been found economical elsewhere.

Cooperation With Technical Societies—So long as any group of intelligent men are studying operations and materials, sents a material or type of pavement for consideration must furnish research or test data from a competent organization to support his claims. This helps to decide what products present enough merit to be subjected to investigation and field service tests.

Investigation of Defects—While real failures in structures or in pavements rarely occur, defects often do occur, and so long as the reason is not ascertained there is no assurance that they will not be repeated. As engineering structures consist mainly of a combination of materials, defects other than those of design may be traceable to materials, fabrication or general carelessness and neglect. Every state testing laboratory should be in a position to investigate cases of this kind. Naturally this requires a well-trained personnel with long experience.

Cooperation with Producers — The laboratory should have close cooperation with producers of all materials that are used by the department. This is especially important in the production of natural products such as sand, stone and gravel. Many times an efficient materials engineer is able to suggest corrections at a plant beneficial to both the producer and the highway department as consumer.

One point which should be stressed is that only well-trained experienced engineers may be assigned to this class of work; inexperienced inspectors and engineers are not only unreliable but

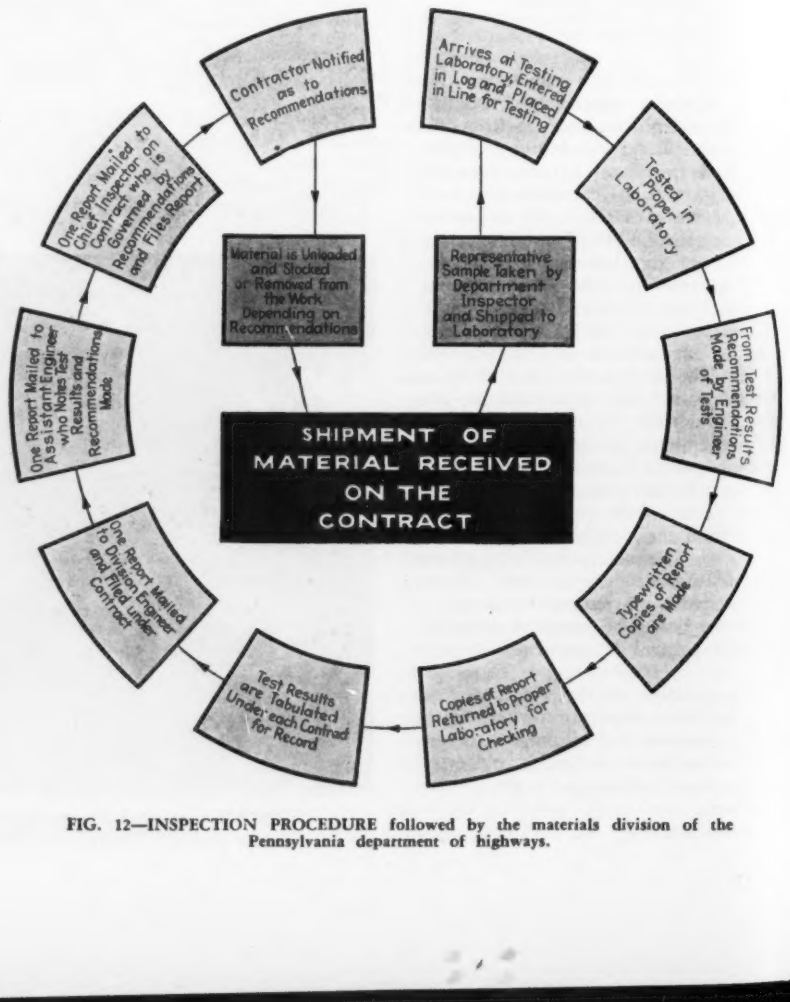

Contractor Notified as to Recommendations
Arrives at Testing Laboratory, Entered in Log and Placed in Line for Testing
Tested in Proper Laboratory
From Test Results Recommendations Made by Engineer of Tests
Typewritten Copies of Report are Made
Copies of Report Returned to Proper Laboratory for Checking
Test Results are Tabulated Under each Contract for Record
One Report Mailed to Division Engineer and Filed under Contract
One Report Mailed to Assistant Engineer who Notes Test Results and Recommendations Made
One Report Mailed to Chief Inspector on Contract who is Governed by Recommendations and Files Report
Material is Unloaded and Stocked or Removed from the Work Depending on Recommendations
Representative Sample Taken by Department Inspector and Shipped to Laboratory
SHIPMENT OF MATERIAL RECEIVED ON THE CONTRACT

FIG. 12—INSPECTION PROCEDURE followed by the materials division of the Pennsylvania department of highways.

rials, progress is to be expected. Many national technical societies have such groups and all state laboratories should cooperate in and take advantage of the results of such studies. While such studies will be published and made available to all who wish to consult them, an efficient state laboratory does not wait for publication; it is familiar with and in a position to adopt them prior to publication.

An efficient, well-trained personnel is essential for the economic operation of any highway department; this is doubly true of the testing laboratory. Cost of materials are such a large percentage of the total cost of finished construction that the determination of quality must be placed in the hands of experienced employees.

Among new developments in the highway field are soil studies and soil stabilization problems. A laboratory for the study of soil is a new addition to many state laboratories, and excellent progress is being made along this line. Until fully developed much of this work should be under the supervision of the state testing laboratory.

The kind and type of organization to control the materials used in construction will in a large measure be regulated by the amount expended by the main organization. It is rather difficult to designate what the proper cost should be for a material control division. Where such a division operates with full responsibility for the control of materials, and carries on sufficient research work to guide the field in proper use of materials, an expenditure of 0.5 per cent of the construction cost is fully warranted. Such projects should be financed under a separate appropriation.

The successful operation of materials control depends to a large extent on sincere cooperation on the part of the executive departments and the field forces. At the same time a laboratory or materials division has responsibility on its par to simplify the operations required in the field as much as possible. Some of the methods proposed for control of materals in the field at the present time, although labeled as simplified methods, are extremely complicated in operation, requiring considerable increase of work and additional responsibility for the field man. Success of this, as in all other organizations, depends on cooperation of the entire department toward the one goal—better and safer highways.

Job Supervision Increased

Growing federal and state regulation are a call to organize more comprehensively for recording and analyzing construction data

E. D. PARKER
District Engineer, The Lane Construction Corporation, Meriden, Conn.

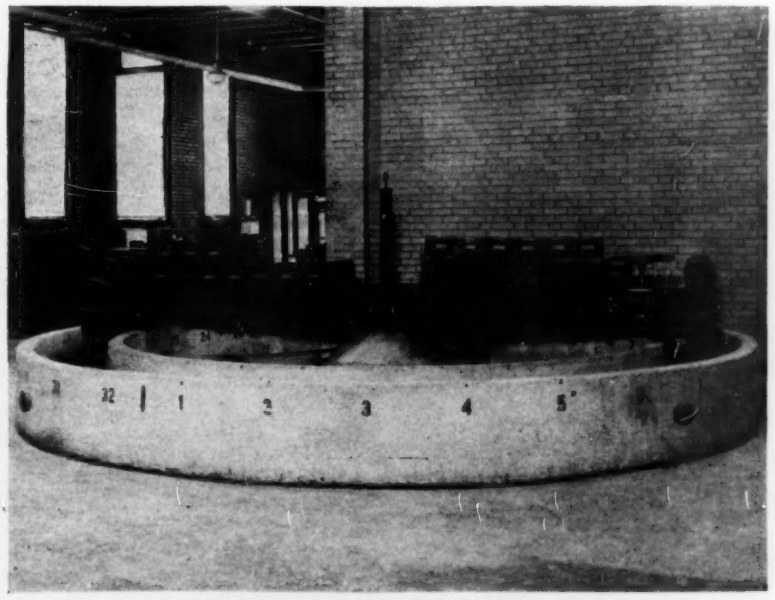
EVERY CONTRACTOR who is attempting to carry on today in the field of highway construction, whether with large or small organization, is performing work under conditions beset with an endless amount of restrictions, regulations both state and federal, arbitrary rulings and the keenest competition in the history of the industry. To meet these conditions an organization beyond previous practice is necessary for the intrasupervision of his operations.

The field of activity of the larger highway contracting organizations generally comprises several states, with a home office central to the territory covered. The purchasing, payroll, and accounting departments covering all contracts should be located in the home office. Also with the exception of local purchases of supplies and materials adjacent to a contract, everything can be bought to advantage on order from the main office. A simplified yet positive system of carrying on this branch of the work should be adopted in order that the field requirements may be met with a minimum of delay and to forestall a duplication of invoice payments.

Every separate contract should have a superintendent in charge of all operations, and the necessity for selecting a man with the very best of qualifications for this important position cannot be over-emphasized. Upon the superintendent rests the responsibility for developing and maintaining an organization that will prosecute the work with the maximum of efficiency in operation.

Inasmuch as the majority of contracts may be located some distance from headquarters, it is imperative that the superintendent should be competent to make important decisions covering policies of operation and also capable and desirous of carrying a full measure of the responsibility imposed upon him. Due to the multiplicity of types of pavement surfaces being constructed in different localities, the superintendent must be resourceful and ever on the alert in devising improved methods of constructing the various types specified. Again the fact that the average highway contract is several miles in length compels the superintendent to keep constantly traveling over the entire length of the work, which is a disadvantage in comparison with other types of construction more or less segregated.

On every contract of size, in addition to timekeeper, foremen and master mechanic in supervisory capacities, there should be one or more (depending upon the scope of the work) assistant superintendents who will be directly in charge of some major operation—such as grading, or drainage or surfacing operations, or in some cases all the work being done. Under present conditions, the superintendent has to spend considerable time working with relief and employment agencies in trying to develop an adequate organization of skilled and unskilled labor, and the superintendent should have at least one assistant to carry on the active work



CIRCULAR TRACK for laboratory tests of road surfaces for wear and stability at Pennsylvania highway laboratory.

while the principal is so occupied. Furthermore, every well ordered organization should have men training in back of all executives and supervisors in preparation for the added responsibilities they may be asked to assume at any time.

Sometimes the contractor with a small organization can eliminate the expense of employing a superintendent by acting in that capacity himself. On the other hand, when a contract has been completed with no other work in sight, it may become necessary to release his organization and thereby lose an investment in experienced talent with the probability that when another contract is secured he will have to develop a new organization. The contractor with a small quantity of mechanical equipment is necessarily restricted to a limited field of operation.

Equipment supervision

Due to the relatively high percentage of mechanical operations on most contracts, a general knowledge of the various types of equipment used and a definite idea of the maximum production possibilities of each piece of plant should be an essential part of a superintendent's qualifications. Although delays caused by mechanical breakdown are inevitable wherever machinery is used, with resulting necessity for immediately transferring the organization from one operation to another or temporarily suspending activities, these delays may be kept at a minimum if the superintendent has the ability to know definitely that his mechanics and operators are actually working to the best advantage.

An important part of an organization is one or more centrally located permanent repair shops for use in general overhauling and major repair of equipment. This work can be done to advantage during the winter months when field mechanics would otherwise be idle.

Records control

An accurate classified record of costs is an essential branch of the accounting system of any successful contractor, and such a record can only be as reliable as a strict and uniform adherence to a well defined method is observed in formulating and submitting reports from field to main office. Here again, under the stress of present conditions, it would be necessary to employ timekeeper and clerical talent in the field with ability well above the average to feel assured of the accuracy not only of the contractor's own records, but also of the various reports required by state and federal authorities.

Until recently the contractor who carried a limited amount of work with a small organization could dispense with practically all office overhead expense if he so desired by confining his records to a time book and check book carried in his hip pocket. However, at the present time, in the face of demands by federal and state officials for accurate and detailed records properly filed and available for examination at all times, it would appear absolutely necessary for every organization, however small, to carry an office force adequate to meet these demands, with possibly a resulting higher ratio of such expense than for the larger operator.

The field of highway contracting has developed into a highly specialized industry demanding a broad experience, adequate financial resources and unlimited courage in order to merit any hope of reward.

State Control Practices

New equipment and construction technique call for better organization and more capable inspection

C. M. HATHAWAY
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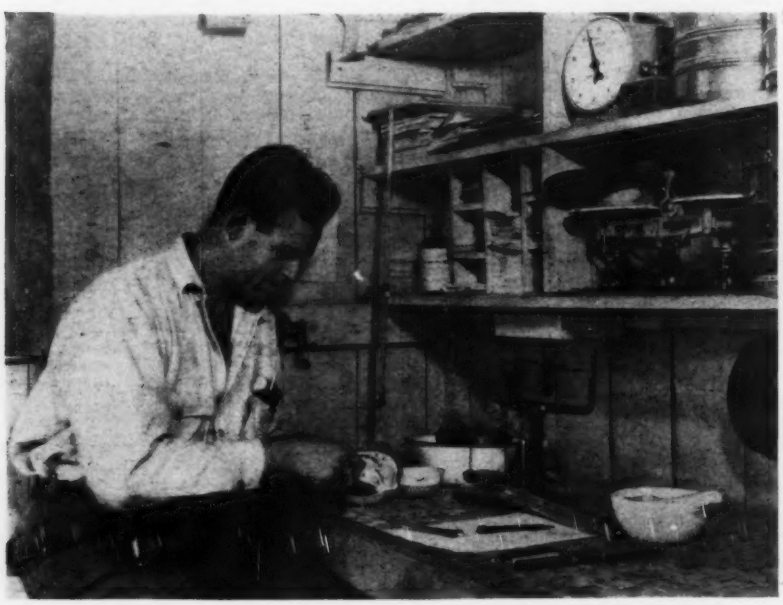
IN SO FAR as state highway work is concerned, and in large degree all other highway construction, the development of state highway engineering organizations, the adoption of design and construction practices based on experience and sound engineering principles and specifications standardized through federal participation have produced a contracting fraternity which realizes that questionable workmanship is no longer tolerated. As a result, the contractor in bidding on a job knows almost exactly the type of inspection which will be given and the quality of work which is essential. In addition, the increase in highway construction throughout the nation has enabled reputable contractors to procure equipment fitted to the job and to develop competent organizations and skilled craftsmen. Prequalification as to ability and finance has eliminated the undesirables and permitted legitimate contractors to make a rational bid.

A second factor in changing the status of the engineer-inspector of today is the constant advancement in design and construction standards and specifications brought about by research and experimentation and application of the results to practical construction methods.

Even with very little inspection the average contractor of today will produce a job of passing quality——say, 70 to 80 per cent. But present-day practice demands as near 100 per cent as possible. This can be accomplished only by constant supervision through competent and experienced engineers, watching each construction detail as the job progresses. Although modern mechanical equipment has eliminated many lax construction methods, nevertheless the human element in common labor must be continually watched—not intermittently but at all itmes. The construction organization of the modern



PLASTICITY TEST made in soils laboratory is a check on the fitness of the stabilized material being produced for road surfacing.

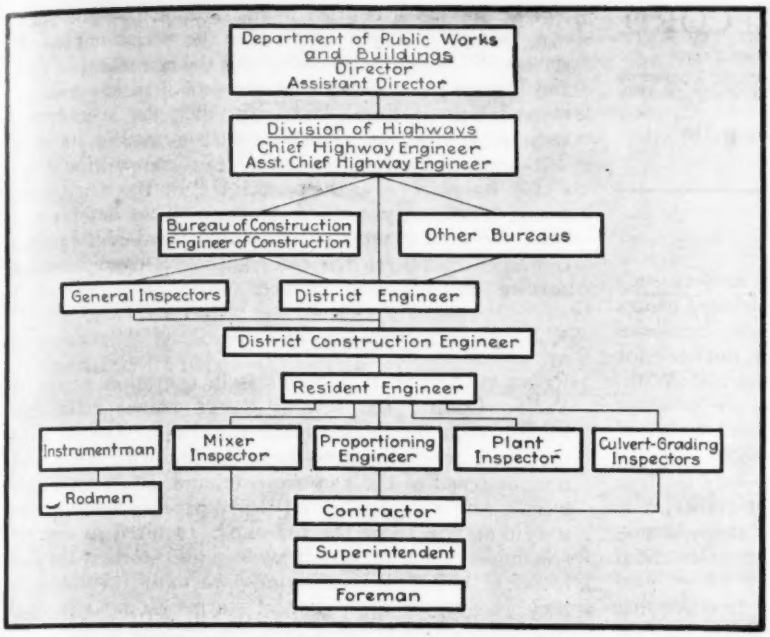


FIG. 13—ORGANIZATION CHART for the Illinois highway department, showing the division and spread of supervision from the head down to the contractor.

highway department is developed to meet these requirements, and the term may be extended to mean not only a state highway department but also road departments of the lesser political units, as the county, city and township. Fig. 13, the construction organization chart of the division of highways of the state of Illinois, probably represents an average engineering-inspection unit.

In Illinois, design, construction, maintenance and other major activities of the department are handled by bureau chiefs reporting direct to the chief highway engineer, and the state is divided into ten geographical divisions, with a district engineer and complete engineering organization in each.

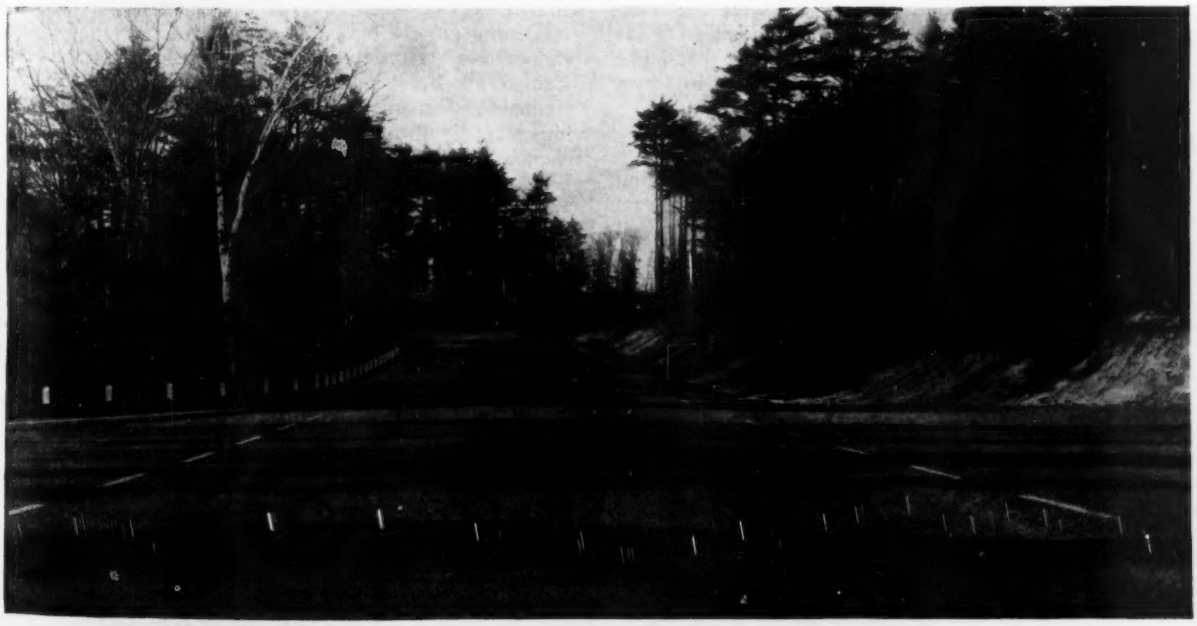
The engineer of construction acts in an executive capacity more than as a detailed supervisor of construction operations. His duties include qualifying contractors, acting as referee in the interpretation of specifications, formulating and correlating matters of policy, making research and investigational studies, and standardizing construction practice.

The general inspectors, under direct control of the engineer of construction, are constantly in the field, visiting each district at frequent intervals and interpreting specifications, standardizing construction practice, studying unusual projects and suggesting such research work as may be desirable for the department to undertake. In view of the limited amount of time that the construction engineer has for detailed inspection, they are really his eyes in this respect, and through them construction policies are developed.

Organized inspection vital

The subject of organization for construction inspection is of prime importance in any highway department, and in the writer's opinion it is too often not given due consideration. Brief mention might be made of federal inspection, since a large percentage of funds during the last few years has been provided by the federal government. Experience has proved to the department the undesirability of having two sets of standards—federal and state; therefore, except for a few regulations as to labor, state and federal specifications are identical.

The discussion of subordinate supervision by the contractor will be left to a member of the contracting organization. In the properly developed construction organization, however, it would be a wise policy in training resident engineers to instill and develop in their minds the logical cooperation between contractor and engineer.



MODERN REFINEMENT in bituminous-macadam construction is calling for mechanical equipment and skilled workmanship that test the abilities of roadbuilders.

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January 16, 1936

To Serve the Field

ANY DISCUSSION of current road matters such as that to which the present issue is devoted brings to view the multitude of ever-changing problems of the highway field and focuses thought on the need for active organization to deal with these problems. Without such organization we cannot hope to see progress keep pace with demand. The American Road Builders' Association, which meets next week, has done yeoman service to the field in the past, and, as the only body in which highway interests as a whole come together, it is the organization which highway engineers and administrators should strengthen and develop as their essential service agency. Its future unquestionably offers possibilities far greater than those of the past. In order that an efficient highway transportation mechanism may be built up and kept in step with the evolution of service needs, both investigational and promotional effort of large proportions will be required. To realize the magnitude of the demands it is only necessary to consider that at present no group is giving adequate study to the major current problems of the moment. Even aside from the broad subject of road investment economics, there is no organization that devotes systematic attention to road system planning, to the layout or structure of express roads, to road operation or traffic regulation, to safety or to lighting. Nor is any group active in dissemination of such knowledge as is developed concerning questions of this kind. Even a moment's thought of such a situation is enough to reveal the large tasks that await the A.R.B.A.'s hands. If they are to be well performed, it can only be through the enthusiastic cooperation of a large membership, through efficient working organization, and through farsighted planning and guidance. It is in this fuller development of the A.R.B.A. that highway men have their great present opportunity to serve.

Fair Competition

SO LONG AS THE INDEPENDENT PRACTICE of engineering co-exists with the engineering school system, the problem of competition between professor and practitioner will remain alive, in all probability. In a recent meeting of consulting engineers at which several school men were present this problem once more came to the fore, and as always with no final clarification of thought. The matter is not one that can be dismissed as trivial, for its effects on engineering practice often are serious. Yet by the same token the questions which it raises cannot be decided by dogma; the very fact that some clients seek the advice and aid of the academic investigator is argument enough against any claim that professorial practice is illegitimate. The simple fact is that if and when the academic consultant in fair competition can displace the independent practitioner, the latter is bound to yield place; he has failed to justify his claim to a special position in the world. Just as clearly the crux of the case lies in the words "fair competition." The engineer whose existence depends on the balance between fees and total cost of service is entitled to insist upon it. The school man competes fairly only when he steps out of the shelter of his salaried position and the command of office and laboratory facilities that the school makes available to him free of cost. And only when the school takes steps to assure that competition from within its doors will respect this requirement of fair competition can it retain its place as a helpful force in the engineering world. These are not severe demands. They deserve to be made the basis of an explicit compact between the profession and schools, to the end that sound conditions may survive in engineering practice.

New Ocean Transport

REGULAR AIR MAIL SERVICE is in operation across the Pacific Ocean; for several weeks planes have been leaving each terminus weekly for the 8,700-mile ocean trip, and schedules have been maintained. Two ships now assigned to the run are seaplanes of 26 tons gross weight with a top speed of 184 m.p.h. This speed affords a wide margin above the 133 m.p.h. required to maintain schedules. Such craft outfly winds and storms; they can travel at altitudes where winds are most favorable and they go over or around most storms. The only really troublesome weather condition is a typhoon at one of the tiny islands where the ship must refuel. Usually such storms do not remain long in one spot, and there always is advance knowledge of conditions through constant radio communication. For many months Pan-American Airways, the operating company, has been quietly and systematically scouting out the Pacific route and establishing bases. When the mail service was inaugurated, operations began with a precision that won instant popular acclaim. The award of a U. S. air mail contract has assured financial stability of the service, and the goodwill of the traveling public has become manifest in large registrations for passenger service. Much of this early interest, doubtless, can be ascribed to the novelty of the service, but there are good prospects for a steady demand. This first transoceanic operation on schedule should develop information that will hasten establishment of similar service elsewhere. It seems inevitable that the remaining gaps will be closed before long. Plans for a cooperative Atlantic crossing service by American and British air lines have already been announced. This tremendous broadening of the field of air transport has important significance for the civil engineer. Among other changes it foreshadows greater air terminals than have heretofore been necessary.

The Right Track

MUCH CREDIT is due the Housing Division of the PWA for steadfastly adhering to the fundamental idea that slum clearance and low-rent housing are municipal responsibilities and that the present federal program is one of demonstration only and is not to be perpetuated. Secretary Ickes emphasized this policy again recently at the groundbreaking ceremonies for the Ten Eyck housing development in Brooklyn, largest of PWA housing projects, when he said, "In any really significant long-term housing activity the present relative positions of local and federal agencies must be reversed." In the view of all careful students of housing, the responsibility for initiating, financing, constructing and operating the housing must rest on the municipality, even if federal subsidy or state aid should be found indispensable. This is sound doctrine, and is questionable only to the extent

that it assumes publicly-owned housing to be the only recourse for the slum dweller. There is another possibility that needs exploration, however. This is the limited-dividend corporation, financed by private capital, which was not able to produce results under the initial PWA program and has since been subjected to scorn and abuse. The limited-dividend corporation failed because it lacked the necessary legislative aid to permit it to acquire land and to enjoy low rates of interest; if these defects could be remedied, a great reservoir of private savings might be tapped for low-rent housing, and an additional weapon for attacking the slums made available. The PWA is on the right track in insisting on local responsibility for slum clearance and low rent housing. It could be of further service if it would lend its influence to studies devised to make private as well as public funds available for the task.

Gate or Lock?

TO PREVENT storm overflows carrying pollution from the Chicago River into Lake Michigan, whose water Chicago drinks unfiltered, the Sanitary District of Chicago proposes to build a gate near the river mouth. Under successive cuts in diversions from the lake, finally to 1,500 sec.-ft. in 1938, reversals of the sluggish river flow would occur after (if not during) every heavy rainfall were such protection not provided. To give effective protection, the gate must remain closed until the hydraulic gradient down the canal becomes sufficient to lower the water level near the mouth below that of the lake. Such closure would often interfere with shipping.

Navigation and commercial interests object to the gate and demand a lock, which would be free from the disadvantage just noted. But since a lock would cost nearly twice as much as the gate, the PWA board of engineers of the district has recommended a gate, and funds for it have been made available by PWA to the district. Nevertheless the city wants a lock, and its plan commission has submitted a plan for one (together with an interchange barge terminal at the river mouth) to the War Department. The barge terminal, by providing for freight transfer from masted lake vessels to river barges, would make possible the replacement of the present movable river bridges by fixed bridges, a great boon to city traffic.

The Sanitary District agrees that a lock is a more desirable structure and is willing to contribute what a gate would cost; but the city has no money for the additional expenditure required, and the Army Engineers hold that the government cannot contribute the necessary addition as the improvement is a purely local project. The time element is likely to force the district to an early decision to attempt to raise the additional funds, since even if the War Department grants a permit for a gate there is the probability that injunctions, legal entanglements and property acquisitions would delay completion beyond the prescribed date, 1938.

One consideration is of controlling weight in this tangled situation: The polluted river water must not be allowed to contaminate the city's water supply. This being so, safety combined with maintenance of river traffic dictates adoption of the lock plan. The district after all is the chief agency concerned, and since it alone is in a position to obtain the necessary funds quickly it should proceed with the lock plan. Charging the whole cost to sanitation may be erroneous, but the result will be of general benefit to the district's area. Since the project is thus broadly in the interest of the communities involved, it is unreasonable to quibble over the question of which agency shall obtain the funds and carry out the construction. The district should build the lock, and should undertake the work without further delay.

End the Racket.

TWO THOUSAND tunnel workers doomed to a silicotic death! Of these 476 are already dead, we read in press reports; 169 of them lie in a common unmarked grave in the West Virginia Mountains, 200 more must also be dead by now—at least they have stopped writing to former friends in the tunnel area—and 1,300 remaining unfortunates will soon succumb to the ravages of silicosis! Foremen clubbed protesting workers into a hell of dust-laden air so thick that lights were invisible 5 ft. away, then followed the gangs into a working atmosphere more poisonous than a wave of chlorine gas sweeping across the battlefield! Every blast of dynamite puffed deadly silicosis dust down the throats of sappers who wore no protective masks! Foremen and workers died like flies!

Out of the lurid pages of an obscure radical paper, and echoed by the legitimate press into the very halls of Congress, come these sensational charges, the most unwarranted and vicious that have ever been hurled against a reputable contractor. The target of this attack is the Rinehart & Dennis Co., contractor on the 3-mile hydroelectric tunnel at Hawks Nest, W. Va., in 1931-32, and victim of the first silicosis suits in construction. Even to the uninformed the charges must seem unfounded; to those who know the true facts they are fantastic—sheer bunk. The facts are given in the following news pages.

In 1933 several enterprising lawyers drummed up some 300 suits against the contractor, each claiming silicosis damages of $10,000 to $25,000 or more. The first case dragged out six weeks, only to end in a jury disagreement. Faced with the tremendous expense of defending the remaining suits, the contractor reluctantly settled out of court with the plaintiffs and with the lawyers. A new batch of lawyers swooped into the field with another array of suits by new plaintiffs. In 1934 the first case of this lot again ended in a hung jury. A change of venue, a new state silicosis law and expiration of certain legal rights finally killed the remaining suits. The contractor thought the nightmare was over, but the recent fresh outbursts indicate otherwise.

This case should shake contractors out of their apathy toward the silicosis problem and rouse them to concerted action. Every contractor who has operated a rock drill in cut, quarry or tunnel is subject to the same persecution. Only proper and sane silicosis legislation can stamp out the legal racketeering that has risen out of rock dust.

A resolution directing an investigation of the silicosis problem is now before Congress. Such a resolution should be promptly passed; the time has come to bring out authoritatively all the facts of silicosis hazards, of their prevention and cure, and of the racketeering and barratry that have grown up around them. But the investigation should be complete and fair. By no means should it be placed in the hands of the Secretary of Labor. Competence and impartiality, equal consideration of the problems of contractor, manufacturer and worker, are essential if the inquiry is to have real value.

CURRENT NEWS

Engineering Foundation Elects Officers

At a recent meeting of the Engineering Foundation, in New York, H. P. Charlesworth, assistant chief engineer, American Telephone & Telegraph Co., was reelected chairman; D. Robert Yarnall was chosen vice-chairman, and Alfred D. Flinn continues as director and secretary. Members of the board of directors include George E. Beggs, professor of civil engineering, Princeton University, and Langdon Pearse, sanitary district engineer, Chicago, who were nominated by the American Society of Civil Engineers. A. L. J. Queneau, Otis E. Hovey, George L. Knight, H. P. Charlesworth, and D. Robert Yarnall were named to the foundation's board as representatives of the United Engineering Trustees. Among the new members-at-large is John V. N. Dorr, president of the Dorr Co., New York.

The Foundation Research Procedure Committee is composed of D. Robert Yarnall, L. W. Chubb, F. F. Colcord, F. M. Farmer, Thaddeus Merriman, W. H. Fulweiler, Alfred D. Flinn. Members of the Cement Concrete Research Planning Committee include Prof. Raymond E. Davis, University of California, Roy W. Crum and Robert F. Blanks.

More Relief Money Allotted to Passamaquoddy Power Project

The Army engineers have been allotted $2,000,000 more of WPA funds to continue work on the Passamaquoddy tidal power project near Eastport, Me. It is understood that this money was made available to permit start of some of the smaller dams for the project thus providing work for a number of the men who were recently laid off after completion of the initial housing operations. Employment reached a peak of 4,500 in the late fall of 1935, but winter forced the shutting down of some of the work, and the original allotment of $5,000,000 had been considerably depleted.

Funds Reallotted for Texas Flood Control

President Roosevelt has approved restoration of $3,000,000 to the sum that the federal government will contribute toward construction of the Lower Colorado River project in Texas. His action again raises to $5,000,000 the total allocated to the Bureau of Reclamation, for flood control and irrigation. Commissioner Mead returned to Washington Dec. 23 from an inspection of the project.

Originally $20,000,000 was allotted from work relief funds to cover construction of the project, which is designed to regulate the Colorado River of Texas for flood control and power generation.

Of the total allotment $10,500,000 is secured by revenue bonds of the Lower Colorado River Authority, a Texas public body which will operate the project, and $4,500,000 was a grant to the Authority representing 30 per cent of the cost of labor and materials.

Under a contract between the Secretary of the Interior and the Authority the Bureau of Reclamation is to supervise the construction. Originally $5,000,000 was allotted to the bureau, but later $3,000,000 of this allotment was rescinded. The reallocation of the $3,000,000 again places the project on its original basis.

The project includes completion of Hamilton Dam near Bluffton, Tex., and a unified system of new dams and reservoirs along the lower river in the general vicinity of Austin.

New Mexico Asks Dismissal of Rio Grande River Suit

The state of New Mexico, on Jan. 13, petitioned the U. S. Supreme Court to dismiss the suit of the state of Texas for a ruling on each state's allowable share of the waters of the Rio Grande River. In its petition New Mexico charged that the United States should have been named a defendant because an adjudication of water, such as is asked for by Texas, would affect the lands and villages of the Pueblo Indians in the area. New Mexico also contends that the state of Colorado should have been named a defendant.

Wild Silicosis Tales Reach Congress

Representative Marcantonio introduces resolution calling for investigation of alleged silicosis deaths, based on wild rumors and press items about Hawks Nest, W. Va., power tunnel, which are refuted by known facts

APPARENTLY inspired by wild rumors originating in the mountain villages of West Virginia and by sensational items published in a Chicago radical weekly newspaper, Representative Vito Marcantonio, of New York, introduced in the House on Jan. 13 a resolution directing the Secretary of Labor to appoint a board of inquiry into facts relating to the health conditions of workers employed in the construction and maintenance of public utilities. The resolution is directed at alleged contraction of silicosis by workers on the power tunnel of the Hawks Nest hydro-electric project on the New River in West Virginia, driven in 1930-1932 for the New-Kanawha Power Co. The resolution has been referred by the House Labor Committee to a sub-committee, which will hold hearings beginning the last of this week to determine the fate of the bill.

The preamble to the bill declares that 476 of the workers employed by the Rinehart & Dennis Co., of Charlottesville, Va., contractor on the project, have from time to time died of silicosis contracted on the job. It states further that 1,500 additional workers are now suffering from the disease, and that 169 of those that died were buried in a field with "cornstalks their only tombstones and no means of identification." The preamble continues with a definition of silicosis, and charges that similar conditions exist on other public utility construction work.

Other wild charges

In addition to the charges mentioned in the resolution, the Chicago paper has published lurid tales about alleged conditions at the tunnel. These same tales are mountain gossip in West Virginia, an indication of their source. It has been charged that dry drilling was the exclusive method used, resulting in a dusty atmosphere so thick that "a locomotive headlight could not be seen 5 ft. away, and that workers were unable to distinguish their associates." One tale reports that foremen were forced to club the workers with pickhandles to make them enter "the tunnel of death." Workmen dropped like flies within the tunnel, it is charged, several each day, choked with the deadly silica dust. The ventilation plant never worked, another report states, and the management refused to supply masks as a protection for the workers. These are but a few of the fantastic tales being circulated and published.

Facts of the case

The true facts, obtained from E. J. Perkins, of the Rinehart & Dennis Co., and by personal investigation of the tunnel project during construction by an editor of this journal, clearly refute the charges. The visiting editor found the tunnel work being carried on according to the highest standards, well ventilated, the atmosphere remarkably clear and free from dust, and safety and accident prevention above the average for tunnel work. All drilling was with wet drills.

The tunnel is 16,282 ft. long, of which 10,700 ft. is 31 ft. diameter inside of concrete lining. The remainder is unlined, varying from 42-ft. circular diameter to 46-ft. horseshoe section. It was driven from four headings, one from each portal and two from an adit located about midpoint. The upstream third lies in shale, the remainder in hard sandstone (not glass sand as some reports charge). The heading and bench method of driving was standard, a top heading being drilled horizontally, the bench by down drilling. The bottom segment from 5 to 15 ft. deep, depending on the diameter, was left in place until later, serving as a flat floor during main driving operations. Drilling equipment was Ingersoll Rand N-75 drifters, N-75 and X-59 jackhammers, all equipped with water heads for wet drilling. Mucking was by electric shovels and car removal.

Ventilation was by electric-drive blowers, each having a capacity to deliver 7,000 cu.ft. of free air per min. at a heading 4,500 ft. from the fan. One unit was installed at

each portal and at the adit. Ventilation air was conducted to the headings through 24-in. canvas tubing from each portal; through 20-in. ducts to each heading from the adit for the first 2,000 ft. of heading. Another unit was installed at the adit later, and two more units were ultimately installed within the tunnel to assist in blowing the air out to the portals and adits, all operating through vent ducts. Fresh air supplied by the blowers and by the drill exhaust averaged more than 150 cu.ft. per min. per man, much more than is required by the state mining laws.

Besides the tunnel the Rinehart & Dennis contract included a diversion dam, power house, surge chamber excavation, and other minor features. The total number employed on the entire contract was 4,948, of which 3,280 were colored. The maximum employed at one time was 1,250, of which 850 were colored. Exact figures on the total employment in the tunnel are not available, for many workmen were employed both inside and outside at various times, but the contractor estimates a total of 2,500 worked underground, 2,000 of them colored.

Accident record excellent

The first heading was turned June 19, 1930, the last section holed through September 19, 1931, and final cleanup of excavation was made June 20, 1932. In the 30 months from the start of driving to the end of 1932, a total of 65 deaths of all workmen, both outside and tunnel, occurred, six whites and 59 colored. Causes of these deaths were: accidents (including two manslaughters in fights) 17; pneumonia, 35; tuberculosis, 3; heart trouble, 4; typhoid, 1; unclassified, 5. This death rate of contractor employees is less than half of the normal death rate for the county in which the work is located, listed as 12 white males and 23 colored males per thousand population. Of the fifteen fatalities resulting from construction accidents, eleven were from underground mishaps, a remarkably low record in comparison with tunnel work in general. The accident record of the entire job is excellent. Medical facilities included a resident physician.

As to the charges that "169 dead lie in a field with only cornstalks for tombstones" the contractor actually buried 45 paupers and unknown men who died at or near the job. A local undertaker contracted to bury the paupers for the same price he received from the county for similar cases, $55 each. He buried 33 in one cemetery and nine in another. Each grave is marked with a wooden marker, and the name of each deceased is carried on a map on file at the undertaker's office. Some of those buried at the contractor's expense had no connection with the job, but were loafers and stragglers who happened to die in or near the camps. Clubbing the unwilling workers into the tunnel is also a fantastic charge, for the labor supply greatly exceeded the demand at all times, and if any worker had refused to enter the tunnel there would have been a dozen to take his place.

Finally, in respect to the charge that the contractor refused to supply the workmen with respirator masks, even if the tunnel had been dusty enough to require the use of masks, none was available. Respirators have been on the market for years, but it was not until October, 1934, that the first mask was developed that had the approval of the U. S. Bureau of Mines as being effective against rock dusts.

Mason & Walsh Quit Fort Peck Tunnels

Bores to be completed by day labor as contractor and government fail to agree on prices for revised lining

BY MUTUAL AGREEMENT the Mason & Walsh Company has relinquished its contract for the driving and lining of the Fort Peck dam diversion tunnels, effective Jan. 15. The government will complete the tunnels with its own forces, taking over all the equipment and most of the organization of the contractor. Failure to agree on prices for a revised design of lining that will permit the tunnels to be completed in time for diversion of the river in the spring of 1937 is given as the reason for giving up the work.

Contract over $7,000,000

Contract for the driving and placing of part of the lining of the four diversion tunnels, aggregating 4.79 miles in length, was let in April, 1934, to the Mason & Walsh Company for $7,311,940. The firm is a combination of the Silas Mason Company, of New York, and the Walsh Const. Co., of Davenport, Ia. The original plans, upon which the contract was based, called for driving of a 16x14-ft. center drift the full length of each tunnel, then enlarging to an outside diameter of 32 ft. 2 in., and placing of a reinforced-concrete lining 27 in. thick along with encased steel rib supports. It was intended under a subsequent contract to place an inner lining of 1-in. steel plate protected by a 9-in. thickness of inner concrete lining. Extensive open cut excavation at the portals, heavy retaining walls, four 60-ft. control shafts at the center of each tunnel and installation of control gates were all included in the original contract (*ENR*, Aug. 29, 1935).

The Mason & Walsh contract completion date was April, 1937. Placing of the inner lining would require about another year, delaying diversion of the river until 1938. Rapid progress made last season in placing the earth fill in the dam led to a general revision of the project construction schedule, calling for river diversion early enough to permit closure of the river section during the 1937 season. By changing the tunnel lining from the double type as contemplated to a single thickness of 36 in. of heavily-reinforced concrete, the tunnels will be ready for the desired earlier diversion.

The following statement concerning the relinquishment of the tunnel contract was made to this journal by Major Thomas B. Larkin, U. S. District Engineer, in charge of the Fort Peck project:

"The contract with the Mason & Walsh Company for the excavation and lining of the diversion tunnels at the Fort Peck dam will be terminated by an agreement effective Jan. 15, 1936.

"The Mason & Walsh contract provided for the construction of four pilot tunnels with an aggregate length of approximately 25,000 feet, the enlargement of these pilot tunnels to a diameter of 32 ft. 2 in. and lining with 21 in. of concrete; also, the construction of the inlet and outlet structures and the control shafts. The contract contemplated the placing of an interior lining under a subsequent contract. Although Mason & Walsh are up to their contract schedule, their contract is not due for completion until April, 1937. The letting and completion of a subsequent contract for the interior lining would not permit closure of the dam before 1938 or possibly 1939.

"As the placing of the dredged fill in the dam has proceeded at an excellent rate during the past season, the government has revised the construction plans for the tunnels, providing for their completion in a single operation so that closure of the dam may be made in 1937. As no agreement regarding prices for work under revised plans could be reached by the government and Mason & Walsh, the existing contract will be terminated by mutual agreement. Under the revised plans, the tunnels will be completed by the government with hired labor.

"Up to the present time Mason & Walsh have completed the pilot tunnels, downstream portal structure, a large part of the upstream portal structure and excavation of the control shafts, and enlarged and lined with concrete about 5,000 feet of the main tunnels."

Mayors Request Larger Relief Appropriations

An appropriation of $2,340,000,000 to continue the relief works program in 1937, in addition to the carryover of about $1,103,000,000 from present funds as estimated by President Roosevelt, was urged upon Congress this week by the executive committee of the U. S. Conference of Mayors. This comes shortly after President Roosevelt had submitted to Congress on Jan. 11 a report requested by the Emergency Relief Appropriation Act of 1935 showing that all of the $4,880,000,000 has been allocated, except $55,195,951 and that expenditures (checks issued) totaled $1,672,394,308.18 through Dec. 31. Because of various deductions of FERA, Farm Credit Administration and other agencies prior to passage of the act, only $4,300,000,000 was actually available for allocation.

In his budget message to Congress two weeks ago the President estimated that a balance of $1,102,824,632 would remain for expenditure next year (beginning July 1, 1936). He also said that Congress could appropriate up to $2,136,000,000 for relief works without raising the government's deficit for 1937 over that estimated for 1936, $3,234,000,000, but he indicated that the need for additional relief funds would not be as great as that.

The mayors' recommendation would raise total funds available for 1937 to $3,443,000,000. Expenditures for recovery and relief in the current fiscal year (1936) are estimated in the budget at $2,869,068,187 as compared to actual expenditures in 1935 of $3,068,803,053.

Declaring that at least 500,000 employable persons are on relief who have not been absorbed by the relief works program, the mayors asserted that it is impossible for the cities, states and counties to carry this load of employable relief cases in addition to caring for the unemployable group and their contribution, estimated at 22 per cent, to the cost of WPA work.

Employment created by the program is reported as 3,541,284. Workers were assured by WPA Administrator Hopkins Jan. 11 that they did not need to leave WPA except for a full-time job at standard or going wage rates and that they did not have to accept work "in conflict with established union relationships."

Nationwide Broadcast Enlists Dealers in Housing Campaign

In a nationwide radio broadcast on Jan. 13, with speakers from New York, Chicago and Washington, the Johns-Manville Corp. inaugurated a campaign to enlist all branches of the building industry in a campaign to sell more and better homes. The campaign was directed particularly to the materials dealers throughout the country who had been advised of the broadcast by 10,000 telegrams. The bankers were represented by Robert V. Fleming, president, American Bankers Association, the architects by Stephen F. Voorhees, president, American Institute of Architects. Other speakers were George La Pointe, Jr., president, National Retail Lumber Dealers' Association, Stewart McDonald, Federal Housing Administrator and Lewis H. Brown, president of Johns-Manville. Mr. Brown anounced that his company is planning a comprehensive program of aiding in the construction of model homes, "to show the public why well built homes represent the soundest investments that can be made."

Bills of Engineering Interest Introduced in Congress

Bills of engineering interest got off to a good start at the second session of the 74th Congress with the introduction by Senator Norris, of Nebraska, of a measure proposing a Mississippi Valley Authority along the lines of TVA, and the proposal by Senator Overton, of Louisiana, that $275,000,000 additional be expended for the completion of the flood control program on the Mississippi River. Anxiety as to the erosion of beaches along the Atlantic littoral is reflected in half a dozen bills, while Senator Borah, of Idaho, leads the list of those introducing reclamation moratorium bills. The rivers and harbors committee was among the first to meet with a long list of proposed projects on its calendar. The Foreign Relations Committee has before it a bill introduced jointly by New Mexico's senators, proposing a comprehensive plan for canalizing the Rio Grande. Among the 10,000 bills now pending before Congress are literally hundreds of bridge bills, while the Senate hopper is piling onto the Commerce Committee table a score of amendments to the omnibus flood control bill, which already has passed the House. Various members responded promptly to the President's request for a permanent Civilian Conservation Corps. Limitations placed on highway expenditures in the budget are certain to be overridden if Congress should yield to the desires of individual members for a larger highway fund.

Santee-Cooper Power Project Gets Additional Funds

A loan of $5,500,000 to the South Carolina Public Service Authority for beginning construction on the Santee-Cooper power and navigation project on the Santee, Cooper and Congaree rivers near Columbia, S. C., was announced on Jan. 8 by PWA. This loan is an addition to a recent $500,000 allotment and to a grant of $4,500,000 for labor and material made available by WPA. Total estimated cost on the project is $37,500,000.

The project includes the construction of a dam across the Santee River, 86 miles above its mouth, to form a reservoir from which the waters of the Santee will be diverted into a reservoir formed by a dam across the Cooper River near Pinopolis, 35 miles north of Charleston. It is proposed to install eight units of 25,000 kw. each in a power plant at that point. Also included in the project is the construction of 474 miles of transmission line. Storage of 61,100,000,000 cu.ft. of water is to be provided in the two reservoirs which will produce a regulated flow of 11,000 sec.-ft.

It is also proposed to develop a navigable channel in the Cooper, Santee and Congaree rivers, 145 miles long. The channel will extend up the Cooper River to Pinopolis Dam where there will be a double-lift lock.

The Santee River dam will have a length of 30,000 ft. and a height of 45 ft. and will contain 7,305,000 cu.yd. The Pinopolis dam will have a crest length of 7,000 ft., a height of 80 ft. and will contain 2,660,000 cu.yd. of fill. There will also be 27 miles of dike on the Pinopolis reservoir of an average height of 12 ft.

The Santee-Cooper project originated by private enterprise, has been taken over by the South Carolina Public Service Authority. The project was first put forward in 1924 when the Columbia Railway and Navigation Co. applied to the Federal Power Commission for a license. A license was granted in 1926 and work was started in 1928, but very little work was done on the project (*ENR*, Oct. 3, 1935, p. 481).

Robert Fletcher, Dean of Thayer Engineering School, Dies

Robert Fletcher, director emeritus of Thayer School of Civil Engineering, Dartmouth College, Hanover, N. H., died at his home there on Jan. 7. Professor Fletcher was director of the Thayer School from 1871 to 1918, when he was made director emeritus. He was 88 years old at the time of his death.

Professor Fletcher was born in New York City and attended the City College of New York for three years and then went to West Point, from which he was graduated in 1868. He then served one year on garrison duty with the artillery corps. From 1869 to 1870 he was instructor of mathematics at West Point and in the next year became senior professor and director of Thayer School. He received an honorary master of science degree from Dartmouth in 1871 and a doctor of philosophy degree in 1881, in 1918 he was given an honorary doctor of science degree.

In the construction field, Professor Fletcher served as consulting engineer on many bridges in New Hampshire and Vermont. He was also in charge of the construction of waterworks for Hanover, N. H., and president and engineer of the Hanover Water Works Co. He later became the civil engineering member of the New Hampshire State Board of Health and in 1902 and 1903 was consulting engineer and partly in charge of construction of Enfield, N. H., waterworks and did other consultation on waterworks and sewerage. Prof. Fletcher was, at one time a member of the commission appointed to establish the boundary between Vermont and New Hampshire.

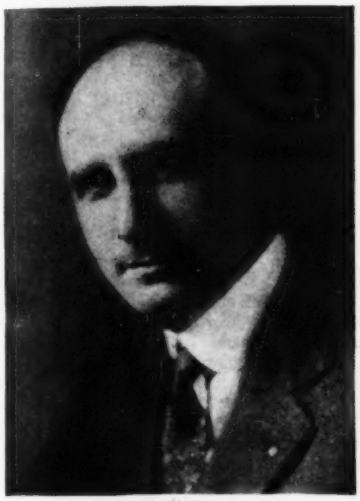
APPROACH TO SAN FRANCISCO-OAKLAND BAY BRIDGE

Airplane view of a portion of San Francisco's waterfront on which the artist has sketched the San Francisco landing of Oakland Bay Bridge as it will look when completed. The bridge comes into San Francisco at a height of 175 ft., with its terminus on Rincon Hill, the highest point in San Francisco. From this point ramps leave the main roadway which reaches ground level at Fifth and Harrison Streets. The width of the main roadway is 58 ft. and of the ramps 20 ft. Interurban trains and trucks use the lower deck of the bridge as is shown in the photo. The highway portion of the bridge is being built for the California Toll Bridge Authority by the State Department of Public Works, of which C. H. Purcell is chief engineer.

A. A. Potter Made President of American Engineering Council

Dr. A. A. Potter, dean of the school of engineering, Purdue University, has been unanimously nominated as president of American Engineering Council for 1936 and 1937, to succeed J. F. Coleman, of New Orleans. Dean Potter took office at the annual meeting of the Council, January 9-11, in Washington, D. C.

Dr. Potter is a past president of the American Society of Mechanical Engineers, the Society for the Promotion of Engineering Education, the Indiana Engineering Society, and the Kansas Engineering Society, which are member bodies of the national Council. He was born in Vilna, Russia, 1882, and was graduated from Massachusetts Institute of Technology. He was awarded a doctor's degree in engineering at Kansas State College where he later became dean of engineering. Since 1920, he has served as dean of the school of engineering, director of the engineering experiment station, and professor of power engineering at Purdue. He is the author of a number of text books, as well as of technical articles and papers published in engineering magazines.



A. A. Potter

The retiring president of American Engineering Council, J. F. Coleman, consulting engineer, is a past-president of the American Society of Civil Engineers, formerly a member of the Engineers Advisory Board of the Reconstruction Finance Corporation, and has been prominent in railroad and municipal construction work.

Sludge Sedimentation at Los Angeles Plant

Treatment of the sewage of Los Angeles, Calif., by sedimentation, with sludge incineration, is to replace screening and incineration of the screenings. Construction on a new plant is in progress with WPA labor and materials as needed. The new plant is designed for an ultimate capacity of 130 m.g.d. It will include bar screens, grit chambers, grease skimmers, clarification tanks, vacuum sludge stokers, sludge dryers and incinerators. The existing plant is one of the few that burns all the screenings.

American Engineering Council

Sixteenth annual meeting in Washington features solidarity of engineering thought; essentials for reviving construction discussed and new officers elected to serve during 1936 and 1937

A SOLIDARITY of engineering thought and action, especially in fields of public affairs affecting professional activities, was the dominant theme of the sixteenth annual meeting of the American Engineering Council held on Jan. 10-11 when representatives of the 42 national, state, and local engineering societies holding membership in council convened in Washington. Progress was reported and new objectives defined in the field of public works, surveying and mapping, planning, civil service, government competition, and other matters of moment to the construction engineer.

The meeting was opened by J. F. Coleman, of New Orleans, president, who spoke on the elements essential in reviving the construction industry. The federal government's survey of the engineering profession was then discussed by George T. Seabury, and by Isador Lubin, Commissioner of Labor Statistics. It was indicated that the returns from more than 60,000 questionnaires will provide information of basic value in charting the future course of the profession. A report is expected in the early spring and plans are being made for the private publication of detailed findings.

Committee reports

Charles W. Eliot, II, described the National Resources Committee work of his organization in forwarding the planning movement. The importance of planning from a regional and local as well as a national viewpoint was stressed. A Senate bill to place the National Resources Committee on a permanent basis was referred to council's public affairs committee for recommendations.

Through subcommittees of the public affairs committee, headed by F. J. Chesterman, the council's policies were perfected in several important fields. The subcommittee on the administration of public works, F. M. Gunby, chairman, reaffirmed the council's past position that engineering public works of the federal government, insofar as practicable, should be concentrated under one qualified head.

The committee on competition of government with engineers in private practice, headed by Alonzo J. Hammond, went on record as favoring the curtailment of competitive activities by government and the raising of consulting fees by public bodies to a basis comparable to private practice.

The water resources committee, under the chairmanship of W. S. Conant, favored complete and correlated basic data, the study of water control legislation, and the establishment of an interdepartmental committee for coordination of federal work in the field of water resources. Patents, rural electrification, and aeronautics were further subjects of reports by public affairs subcommittees.

Mapping and survey committee formed

The assembly adopted the recommendations of the executive committee that the council create a new committee on mapping and surveys and that it endeavor to develop public opinion toward completing the basic map of the United States. It was voted to support the original Temple Act to the end that its purposes be effectuated by appropriations recognizing the fundamental value of mapping rather than on a relief basis.

Leonard D. White, U. S. Civil Service Commissioner, spoke of the need for extending the civil service system among state and local governments as well as in the federal employ, to uphold the professional standards of engineers in the public service. Discussion developed that classification by position is essential in developing a suitably paid civil service. The assembly voted to instruct the executive committee to take steps necessary to put these concepts into action, in cooperation with state and local societies.

Ralph E. Flanders presented the third progress report of the committee on the interrelation of production and distribution, which was referred for study to local delegates and is to be reported back Feb. 1. The maintenance of an economic balance with higher standards of living for all was the main point of approach taken by this committee.

The All Engineers Dinner, held at the Mayflower Hotel on Jan. 10, was attended by 450 engineers. Addresses were made by William F. Durand, chairman of the Third World Power Conference, and by other eminent engineers. The presidents or secretaries of the seven national engineering societies holding membership in council delivered brief talks and expressed their confidence in council as a rallying point for effectuating the policies of organized engineers.

Officers elected

New officers elected at the meeting were A. A. Potter, dean of the Schools of Engineering, Purdue University, president for 1936 and 1937; Ralph E. Flanders, vice-president for two years; J. S. Dodds for one year. Other members of the executive committee and Frederick M. Feiker, executive secretary, were reelected.

The sixth conference of secretaries of engineering societies, attended by more than 30 secretaries of engineering societies throughout the country, was held on Jan. 9, following the precedent set at last year's meeting, in order that these executive leaders of engineering groups might discuss practical matters of society management and other common problems.

New Jersey Greenbelt Project Temporarily Enjoined

A temporary injunction prohibiting the Rural Resettlement Administration from continuing land purchases for its greenbelt project in Franklin Township, N. J., was granted on Jan. 9 by the federal Court of Appeals, Washington, D. C. The court has also set Feb. 3 as the date for a hearing on the application for a permanent injunction, meanwhile enjoining the administration from making binding options or taking deeds on property for the project which is to cost about $6,000,000.

International Joint Commission Chairmanship Changes

Charles A. Magrath, chairman of the International Joint Commission, Ottawa, Canada, has resigned and has been succeeded in that office by Charles Stewart, former minister of the Interior in the Dominion Government. No reason for Mr. Magrath's resignation has been given, other than his expressed desire for release from his duties that he might take a much needed rest.

Mr. Magrath was appointed to the commission in 1911 and has served as chairman since 1914. He served as federal member of parliament for Medicine Hat from 1908 to 1911. He served as chairman of the Ontario Hydro-Electric Power Commission from 1925 until he retired in 1931 and has been a member of several important investigating commissions, such as that on Ontario highways in 1913 and Alberta agricultural conditions in 1920. He is one of the Dominion's outstanding engineers and has played a notable part in the development of western Canada's irrigation system. At one time in his long public career he was Premier of Alberta.

Mr. Stewart was first elected to the Alberta legislature in 1909 and was a member there until 1921. He served successively as minister of municipal affairs, public works and minister of railways and telephones.

SOCIETY CALENDAR

AMERICAN ROAD BUILDERS' ASSOCIATION, annual convention and road show, Cleveland, Ohio, January 20-24.

CONSTRUCTION EQUIPMENT ASSOCIATION, first annual meeting, Cleveland, Ohio, January 20-24.

CANADIAN CONSTRUCTION ASSOCIATION, annual meeting, Hamilton, Ont., January 21-23.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS, annual meeting, Chicago, Ill., January 27-30.

AMERICAN WOOD PRESERVERS ASSOCIATION, annual meeting, Memphis, Tenn., January 28-30.

NATIONAL PAVING BRICK ASSOCIATION, annual meeting, Columbus, Ohio, January 29-31.

ENGINEERING INSTITUTE OF CANADA, annual meeting, Hamilton, Ont., February 6-7.

AMERICAN CONCRETE INSTITUTE, annual meeting, Chicago, Ill., February 25-27.

AMERICAN SOCIETY FOR TESTING MATERIALS, regional meeting, Pittsburgh, Pa., March 4.

AMERICAN RAILWAY ENGINEERING ASSOCIATION, annual meeting, Chicago, Ill., March 10-12.

METROPOLITAN SECTION, AMERICAN SOCIETY OF CIVIL ENGINEERS, New York, Jan. 22.

LOUISIANA ENGINEERING SOCIETY, annual meeting, New Orleans, La., January 24-25.

IOWA SURVEYORS CONFERENCE, annual meeting, Ames, Iowa, January 24-25.

WEST VIRGINIA SOCIETY OF PROFESSIONAL ENGINEERS, annual meeting, Huntington, January 27-28.

NEW JERSEY SECTION, AMERICAN WATERWORKS ASSOCIATION, waterworks session, Trenton, January 29.

NEW YORK BUILDING CONGRESS, Luncheon meeting, New York City, guest speaker SEN. ROBERT F. WAGNER, January 30.

ASSOCIATION OF HIGHWAY OFFICIALS OF NORTH ATLANTIC STATES, annual meeting, Atlantic City, N. J., February 12-14

SOUTHWEST ROAD SHOW AND SCHOOL, Wichita, Kan., February 25-28.

D. W. Mead Becomes President of Civil Engineers

Daniel Webster Mead, of Madison, Wis., was elected president of the American Society of Civil Engineers at its annual meeting in New York City, Jan. 15-18. Other officers elected were: Edward P. Lupfer, Buffalo, N. Y., and Harry W. Dennis, Los Angeles, Cal., vice presidents; Carlton S. Proctor and James K. Finch, New York; C. E. Myers, Philadelphia, Pa.; Raymond A. Hill, Los Angeles; L. L. Hidinger, Memphis; E. P. Arneson, San Antonio, directors.

Mr. Mead, who at present is a member of the board representing the federal government in connection with construction work by the Chicago Sanitary District, was graduated from Cornell University in 1884

Daniel W. Mead

with the degree of civil engineer. He then spent a year with the U. S. Geological Survey and then became city engineer of Rockford, Ill., from 1885 to 1887, at which time he became chief engineer and general manager of the Rockford Construction Co. and held this position until 1896 when he became consulting engineer on hydraulic work and power plants. In 1904 he was appointed professor of hydraulic and sanitary engineering, University of Wisconsin, and held this chair until 1932 when he retired with an honorary degree of doctor of laws. He is a member of the firms of Mead & Seastone, Madison, Wis., and of Mead & Scheidenheld, New York City. In 1914 Mr. Mead was a member of the Red Cross Commission to China on flood protection of the Huai River and served as consulting engineer to the Miami Conservancy District from 1913 to 1920. In 1928 President Coolidge appointed him to the Colorado River Board to pass on the plans for the Boulder Canyon project. Besides contributing articles to technical journals, Mr. Mead has published a number of books on hydrology and water power.

Edward P. Lupfer, who is at present a consulting engineer in Buffalo, N. Y., has spent a number of years in railroad construction work in the East and in the Northwest.

Harry W. Dennis is construction engineer for the Southern California Edison Co. In 1924 Mr. Dennis was made a member of the Engineering Foundation's committee on arch dam investigation.

Carlton S. Proctor, director for District 1, is a member of the consulting engineering firm of Moran & Proctor, New York City. James K. Finch, also elected director for District 1, is Renwick professor of civil engineering, Columbia University. C. E. Myers, director for District 4, is a consulting engineer of Philadelphia, Pa., and Raymond A. Hill, director of District 11, is engineering adviser to the International Boundary Commission. Leroy L. Hidinger, director of District 14 is president of the Morgan Engineering Co., and Edwin P. Arneson, director of District 15 is in private engineering work.

Soil Erosion Service Begins Silt and Erosion Studies

To provide fundamental data on the relation of soil erosion to silting of reservoirs, the Soil Conservation Service is beginning a series of surveys on the watersheds lying above nine reservoirs in Virginia, North Carolina, South Carolina, Georgia, Missouri, Arkansas and Oklahoma. At a later date, surveys will be made in Texas and California. About $100,000 has been set aside for the work. According to H. H. Bennett, chief of the service, the object is to determine how serious soil erosion is in the watersheds, so that this information can be correlated directly with measurements on the extent and rate of silting in these particular reservoirs.

Work is being carried on under the general supervision of Glenn L. Fuller, head of the service's conservation surveys. One survey will cover about 4,760 square miles in Virginia and North Carolina above the High Rock, N. C., reservoir. Three other surveys in North Carolina will cover four square miles above Lake Concord, 170 square miles above Lake Michie and 27 square miles above University Lake. In South Carolina, a watershed area of 89 square miles above Spartanburg municipal reservoir will be surveyed; in Georgia, 1,850 square miles above the Lloyd Shoals reservoir. Parts of the surveys in the Carolinas and Georgia will probably be completed by June, according to Mr. Fuller.

Obituary

WILLIAM GARLAND HARGRAVE, 63, superintendent of ways and structures for the Virginia Electric and Power Co., died Jan. 1, in Norfolk, Va.

C. H. ELLISON, 65 years of age, city engineer of Monterey Park during the past four years, died Dec. 30 at Santa Monica, Calif. Mr. Ellison previously had been with the Southern Pacific Railroad.

OSCAR VEST, 60, member of the Kentucky state railroad commission, died in Louisville on Dec. 23. He had been a member of the commission for the past twelve years.

CHARLES A. ROGERS, president of the Rogers Bros. Corp., Albion, Ohio, manufacturers of heavy duty construction equipment trailers, died in an automobile accident on Dec. 12. Mr. Rogers was 64 years old at the time of his death.

EDWIN J. ROBERTS, vice-president, Roberts Supply, Inc., Lima, O., died Dec. 24. After leaving the University of Michigan

he was actively engaged in bridge engineering and construction until the time of his death.

J. G. OBERMIER, vice president of the Timken Roller Bearing Co., died in Tucson, Ariz., Dec. 28.

STEPHEN HENRY PAYNE, 65, construction engineer, died at his home, Brooklyn, N. Y., Jan. 9. Mr. Payne was head of the Payne Engine Co. until its dissolution in 1900. He was construction engineer for the Louisville & Nashville R.R. at Louisville from 1900 to 1915. Since then he had been a manufacturers' agent for powerhouse and contractors' supplies.

GUY LOOMER, a prominent building contractor at Belmont, Mass., and for many years a partner in the firm of Loomer & Allen, died recently at the age of 70.

WILLARD NEWTON SAWYER, 73, former president of the Wellman Engineering Co., died at Kent, Ohio, Jan. 5. Mr. Sawyer had retired in 1927. He became president of the Wellman concern in 1907, and held that position for eleven years.

CLYDE A. PLASKETT, in charge of container investigations, U. S. Forest Products Laboratory, died Dec. 24 at Madison, Wis. He was graduated in civil engineering from Purdue University in 1917 and a year later joined the staff of the Forest Products Laboratory where he developed research and engineering control of wooden box construction.

CONSTRUCTION STATISTICS FOR THE WEEK

ENGINEERING construction awards for this week total $54,714,000, of which $3,333,000 is for private work and $51,381,000 for public construction. Of the latter, $2,113,000 is federal and $49,268,000 state and municipal. This volume is below the high total of last week but over twice the average week for the first half of last year. The volume for the corresponding week last year is: total, $24,014,000; private, $2,118,000; public, $21,896,000; federal, $5,139,000, and state and municipal, $16,757,000.

The drop from the record highs of last week is principally in the earthwork and waterways and public building classifications. This week's values for these classes of construction are $3,523,000 and $13,542,000 respectively. Waterworks awards are higher this week, $8,136,000, as are also bridges, $4,978,000. Other classifications include: industrial buildings, $1,341,000; commercial buildings, $1,115,000; streets and roads, $12,039,000; sewerage, $4,019,000.

The larger awards include: public school No. 49, Brooklyn, N. Y., $1,058,000; plumbing, heating and electric work, etc., Franklin K. Lane High School, Brooklyn, N. Y., $532,000; senior high school, Providence, R. I., $1,399,000; additions to various schools, Chattanooga, Tenn., $929,000; high school, Ramsey, N. J., $467,000; science building, auditorium, administration building and infirmary, University of Arizona, Tucson, Ariz., $553,000; library, health and education buildings, University of Mo., Columbia, Mo., $716,000; highways by Georgia, $616,000; by Illinois, $1,772,000; by Louisiana, $656,000 and $829,000; by Maryland, $610,000; by Minnesota, $566,000; by Mississippi, $1,311,000; bridges by California, $1,187,000; by Illinois, $406,000; over Calumet River on Torrence Ave., Chicago, Ill., $792,000; chemical building and coagulation basins at water purification plant, Cincinnati, Ohio, $943,000; Metropolitan Water District, concrete and steel pipe for Colorado River Aqueduct, Los Angeles, also Santa Ana River Bridge, four contracts, $5,628,000; 2 mi. sewer South Park Ave., 1 mi. in Cherry St., Chicago, Ill., $1,504,000; North and South Interceptor Sewers, Chillicothe, Ohio, $378,000; sewage disposal plant, Massillon, Ohio, $330,000; canals and appurtenant structures for Maverick Co. Water Control and Improvement District, Eagle Pass, Tex., $1,475,000; lake, dam and boathouse, etc., at North Park, Pittsburgh, Pa., $1,109,000; two contracts for Midtown Tunnel, New York, $3,758,000.

State and municipal bond sales continue strong, totaling $12,128,000 for the week. Assurance is reported of an RFC loan to Colorado for highways, $25,000,000. Corporate security issues for construction purposes total $3,718,000 for the week. Total new capital to date is $134,770,000 compared with $14,659,000 for the corresponding period a year ago.

CONTRACTS

(Thousands of Dollars)

	Weekly Average Jan. 1935	Prev. 4 Weeks	Week Jan. 16 1936
Federal Government	$3,979	$23,341	$2,113
State and municipal	15,399	43,893	49,268
Total public	$19,378	$67,234	$51,381
Total private	5,977	5,364	3,333
Week's total	$25,355	$72,598	$54,714
Cumulative to date: 1935	$98,087,000	1936	$193,984,000

NEW PRODUCTIVE CAPITAL

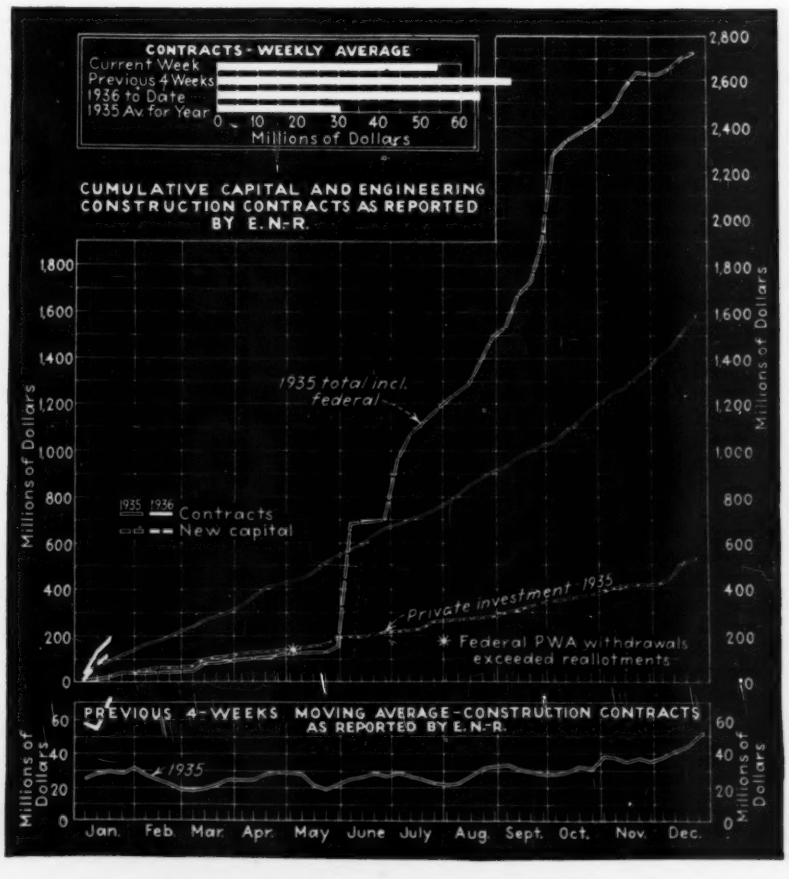
(Thousands of Dollars)

1936	Week Jan. 16	Cumulative
State and municipal	$11,867	$30,059
PWA non-federal	5,500	67,519
RFC loans	25,000	25,000
Corporate issues	3,718	12,128
Total Non-Federal	$46,085	$134,706
Federal	64	64
Total new capital	$46,149	$134,770
Cumulative to date: 1935	$14,659,000	1936	$134,770,000

Note: These figures include private bonds, and stocks sold for productive purposes; state and municipal bonds for construction; PWA loans and grants to states and municipalities, including the special highway funds; PWA private loans, and allotments for federal construction, deficiency act funds. An arbitrary percentage (25%) of the WPA allotments and local contributions to WPA work is included to allow for the capital additions through the Works Progress Administration division of the new program.

INDEX NUMBER

ENR Cost	1913 = 100	1926 = 100	ENR Volume	1913 = 100	1926 = 100
Jan., 1936	199.48	95.89	Dec., 1935	254	111
Dec., 1935	194.90	93.69	Nov. 1935	171	75
Jan., 1935	198.72	95.52	Dec. 1934	105	46
1935 (Av.)	195.22	93.84	1935 (Av.)	135	58
1934 (Av.)	198.10	95.23	1934 (Av.)	114	50
1933 (Av.)	170.18	81.80	1933 (Av.)	102	47


CONTRACTS - WEEKLY AVERAGE
Current Week
Previous 4 Weeks
1936 to Date
1935 Av for Year
0 10 20 30 40 50 60
Millions of Dollars
CUMULATIVE CAPITAL AND ENGINEERING CONSTRUCTION CONTRACTS AS REPORTED BY E.N.-R.
1935 total incl. federal
1935 1936 Contracts
New capital
Private investment 1935
* Federal PWA withdrawals exceeded reallotments
Millions of Dollars
PREVIOUS 4-WEEKS MOVING AVERAGE - CONSTRUCTION CONTRACTS AS REPORTED BY E.N.-R.
1935
Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec.

Construction Equipment and Materials

New Coatings Produce Impervious Films

Technical Coatings, Inc., New York City, is producing a line of new coatings which are free from porosity and impervious to water and corrosive atmospheric gases.

The coatings are a combination of vegeta le gums and heat-treated oils. They form films which are airtight, watertight and elastic.

Primers with the new non-porous base are available for various purposes: metallic zinc, for black and galvanized surfaces and where salt water exposure is severe; a combination of zinc and aluminum for humid conditions where condensation occurs. Finishing coats in standard colors are also available, as is a high-gloss acid-resistant gray. Application is by brush, spray or dipping, as preferred, after thinning with pure turpentine or high-grade mineral spirits.

Truck and Buggy Unit For Fast Earth Moving

The Cradledump buggy, a new earth-moving carrier of 30-yd. capacity, built for use with large tractors, and without the front axle, for use with trucks as a semi-trailer, has been announced by R. G. Le Tourneau, Inc., Peoria, Ill. The Hug Model 100 tractor truck has been developed to handle the buggy.

The combined Cradledump trailer and tractor truck was designed for the use of contractors desiring a powerful, high-speed carrier for long hauls.

The Cradledump has a water-level capacity of 30 cu.yd. and about 35 yd. loose measure, and its inside body dimensions are 9x13 ft. Unloading is controlled from the tractor by means of steel cables and sheaves connected to a two-drum power control unit mounted at the rear of the tractor motor. The body is pivoted at the top and expels its load by moving in a cradle-like arc to the side, forcing the entire load off the buggy as it moves.

The sides of the body are reinforced to prevent binding or twisting. The bottom is separate from the top and is stationary. It serves the dual purpose of a base for the sides and a frame for the running gear and is built to withstand shocks. It has a double bottom consisting of two layers of alloy steel with a 6-in. layer of wood between.

The Hug Model 100 tractor truck has a four-wheel drive and is powered by a diesel engine. It is capable of a top speed of 29 m.p.h and has a low speed of 1½ m.p.h.

Mixer Manufacturer Adds New Model to Line

The T. L. Smith Co., Milwaukee, Wis., has recently added to its line a four wheel end discharge model in the 10-S size. The new machine, compact and light in weight, combines the advantages of the two wheel end discharge model with four wheel truck stability.

The truck design of this new machine provides for a 5-ft. wheel base. Automotive type steering axle, 3-point suspension with spring mounting and balanced weight, permit fast towing speeds. Engine mounting on the right hand side avoids any overhang on the traffic side. The telescopic tow bar folds back while mixer is in use.

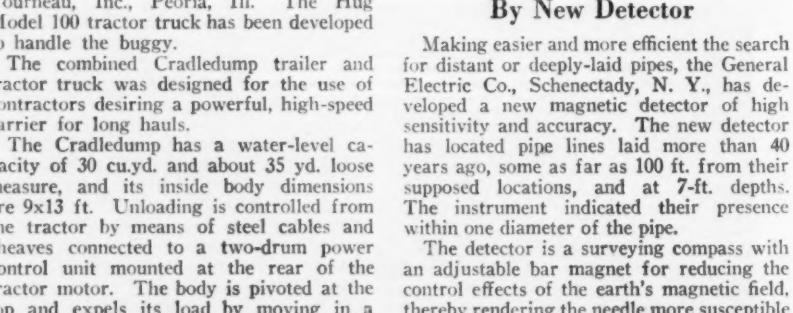
Other features include the enclosed gear reduction running in oil, multiple V-belt drive, automatic skip vibrator and a vertical siphon type water-measuring tank with calibrated gage.

Hidden Pipes Located By New Detector

Making easier and more efficient the search for distant or deeply-laid pipes, the General Electric Co., Schenectady, N. Y., has developed a new magnetic detector of high sensitivity and accuracy. The new detector has located pipe lines laid more than 40 years ago, some as far as 100 ft. from their supposed locations, and at 7-ft. depths. The instrument indicated their presence within one diameter of the pipe.

The detector is a surveying compass with an adjustable bar magnet for reducing the control effects of the earth's magnetic field, thereby rendering the needle more susceptible to magnetic disturbances produced by a pipe. The bar magnet is adjustable for height and azimuth.

The detector is sensitive to iron or steel pipe lines having any magnetic bearing, and at a considerable distance away. It may be used with or without electric current through the pipe, although the establishment of a small current makes for easier and more certain search. Easily manipulated and rapid in results, it will also determine the depth of a pipe within a few per cent.



New Equipment in Brief

Chain Drive Selector. A chart to be used in determining the selection of the proper silent chain drive is now made available by the Morse Chain Co., Ithaca, N. Y. The chart is 8½x11 in. and has heavy cardboard covers, between which is a sliding card. In order to find the dimensions of a drive necessary to give the desired revolutions per minute, the slide is moved until the required r.p.m. of the driven sprocket shows in a window beneath the r.p.m. of the driving sprocket. Two other windows are so located in the chart that when this is done, the outside diameters of the driving and driven sprockets, the standard center and the length of chain necessary to give the desired speed may be read.

Small Capacity Pump. The Homestead Valve Manufacturing Co., Coraopolis, Pa., has developed a miniature triplex-plunger reciprocating pump. Depending upon the speed of the pump the capacity may be varied from about 15 to 120 gal. per hour. The power required by the pump is small, so that a ¼-hp. motor will operate the pump at 60 gal. per hour capacity and 200-lb. pressure. It is a single-acting plunger type having three cylinders of ¾-in. bore and ⅝-in. stroke.

Metal-working Lathe. The South Bend Lathe Works, South Bend, Ind., announces that the new V-belt drive is now optional on the 9-in. precision lathe in place of the standard flat-belt drive. The lathe has a four-step cone headstock, with a single V-belt drive from the countershaft. This provides eight spindle speeds, four on open belt and four in back gear, ranging from 44 to 585 r.p.m. The V-belt drive can be obtained only with the adjustable type countershaft. In addition to the V-belt drive the lathe features twin gear reverse for right and left hand threads and a ball thrust bearing on the headstock spindle.

New Publications

SIZES WE ROLL, Inland Steel Co., Chicago, Ill. 3¾x8½, 64 pages.

ROTARY DISTRIBUTORS, Pacific Flush-Tank Co., Chicago, Ill. 8½x11, 15 pages. Bulletin 113.

SERIES A AND SERIES AP WICO MAGNETOS, Wico Electric Co., Springfield, Mass., Two Bulletins, 8½x11, each 8 pages.

DUPLEX COMPRESSORS, TYPES XRE, XRB and XCB, Ingersoll-Rand, New York City. 8½x11, 35 pages.

STEAM TURBINES FOR MECHANICAL DRIVE, General Electric Co., Schenectady, N. Y. 8½x11, 16 pages.

DURO-BRACE TEXSTEEL SHEAVES, Allis-Chalmers Manufacturing Co. Milwaukee, Wis. 8½x11, 15 pages.

THERMAL EXPANSION CHARACTERISTICS OF SOME NICKEL CAST IRONS, International Nickel Co., Inc., New York City. 8½x11, 8 pages.

MASTER VIBRATORS, Master Vibrator Co., Dayton, Ohio. 8½x11, 14 pages.

Business Notes

TOLEDO SYNTHETIC PRODUCTS, INC., maker of Plaskon, announces a change in name effective Jan. 1, 1936. The new name of the company is PLASKON CO., INC.

TRUSCON STEEL CO., Youngstown, Ohio, announces the appointment of Kenneth D. Mann as executive vice-president. Mr. Mann formerly was Southern district sales manager of Republic Steel Corp., with headquarters in Birmingham, Ala.

CONSTRUCTION REPORTS

WATERWORKS

PROPOSED WORK

Conn., New Britain — City plans 1 m.g.c. standpipe on city property at High Service Reservoir, Corbin Ave., height 100 ft., to improve pressure at high points of city. $51,000. J. W. Holden, City Hall, engr.

Mass., Harwick—Town, J. Crowell, chn. Bd. Selectmen, Town Hall, making plans 16 mi. c.i. pipe watermains, pumping station and elevated steel tank. Total est. $260,000. P.W.A. grant $117,000. Whitman & Howard, 89 Broad St., Boston, engrs.

Mont., Billings—Yellowstone Co. plans constructing 4 and 8 in. c.i. mains, concrete reservoir, furnishing, installing pumping plant. Special Impvt. Dist. 25 to furnish residents along Rimrock Rd. from city reservoir to Rehberg Rd. then to Virginia Lane, about 7.5 mi. $57,000. C. E. Durland, Billings, co. surv.

Neb., Alvo—City plans constructing waterworks. $19,091. P.W.A. allotment approved. Henningson Eng. Co., Union State Bank Bldg., engrs. Noted Sept. 19, C. D.—Sept. 26, E. N.-R.

Neb., Murdock — City plans constructing waterworks. $18,181. Nixon & Reynolds, Grain Exch. Bldg., Omaha, engrs. P.W.A. allotment approved. Noted Sept. 24, C. D.—Sept. 26, E. N.-R.

Neb., Omaha — Metropolitan Utilities Dist. plans enlarging pumping plant, new pump, $14,850. P.W.A. allotment approved. J. C. Detweiler, ch. engr.

Neb., West Point—City plans waterworks and street lighting system. $16,114. P.W.A. allotment approved. Nixon & Reynolds, Grain Exch. Bldg., Omaha, engrs. Noted Sept. 25, C. D.—Oct. 3, E. N.-R.

N. Y., Allegany — Village plans extending c.i. watermain distribution system, replacing 2 in. hydrant line with 6 in. line. **Maturity in Spring.**

N. Y., Red Hook—Village, waterworks. Bids taken Dec. 30, exceeded appropriation. Will apply for more funds or revise plans and readvertise. Noted Dec. 30, C. D.—Jan. 2, E. N.-R., under "Contracts Awarded."

N. C., Andrews—Town filed application with P.W.A. for loan to finance construction waterworks and sewer improvements. $54,545. A. H. Vanderhoof, Asheville, engr.

N. C., Colerain—Town filed application with P.W.A. for funds to finance construction water and sewer improvements. $28,409. P. M. Van Camp, Southern Pines, engr.

N. C., Plymouth—Town filed application with P.W.A. for funds to finance waterworks improvements. $65,454. W. C. Olsen, Raleigh, engr.

N. C., Vanceboro — Town filed application with P.W.A. for funds to finance water and sewerage systems. $63,636. J. B. McCrary Co., 22 Marietta St. Bl., Atlanta, Ga., engrs.

O., Toledo—City, plans 10,000 4 and 6 in. c.i. pipe, to Pearson Park, East Side from city lines. $35,000. Not yet approved by W.P.A.

★ **Pa., Easton**—Election Jan. 28, $550,000 to acquire holdings of Lehigh Water Co. and improve same. Total purchase price $2,750,000.

Pa., Parkers Landing—Parker City Water Co. bids about Feb. 1, replacing present waterworks and distributing system with modern plant. Owner's eng. dpt., engrs. Noted Nov. 14, C. D.—Nov. 21, E. N.-R.

Wash., Everson—Town will vote again on $11,000 proposition to pay part of cost of water system, due to defect in election details. F. W. McKemon, Everson, engr.

Wash., Seattle—Water Dist. 3, King Co., election Feb 8, $14,000 bonds to enable Secretary W. H. Harris, Empire Bldg., to call bids for materials for 14,680 ft. 4- to 12-in. c.i. mains to connect with Seattle water system, $20,000. W.P.A. to furnish labor. N. Aull, 1839 McGilvra Blvd., engr. Noted Jan. 6, C. D.

Wash., Port Angeles—Town plans new well for additional water supply and pumping equipment (4,000). $25,000. H. E. Dodge, Port Angeles, engr.

Wis., Dresser Junction—Municipality plans waterworks. $25,000. P. R. Banister, Hudson, engr.

B. C., Nanaimo—Municipality preparing plans completing water pipe line. $200,000.

N. S., Kentville—Town Council, F. C. Wightman, mgr., plans installing water meters.

Ont., London—P. Utilities Com., E. V. Buchanan, genl. mgr., plans drilling 3 new water wells on Ridout St. property, replacing casings on present wells and replacing some of the older waterworks conduits at Springbank. $43,000.

Ont., Windsor — Municipality purchased 64 acres of land near filtration plant for pumping plant.

BIDS ASKED

†**Calif., Mare Island**—Feb. 5 (extended date), by Bu. Yards & Docks, Navy Dpt., Wash., D. C., 2 water treatment systems, continuous blowdown system and chemical feeding system at Navy Yard, Spec. 8092.

Neb., Ashland—Jan. 29, by City, furnishing, installing deep well turbine pump, retaining wall for well and standpipe, installing gasoline storage tank with pump. W.P.A. project.

N. Y., White Plains—Bd. Supervs. Westchester Co. taking bids constructing stand-by water tank at county institutions in Grasslands, near here. $6,500.

Pa., Blaw Knox — Jan. 27, by W. R. Dripps, boro secy., Boro Bldg., water lines, elevated storage tank, motor driven boster pump with automatic control, meters, valves and fittings, vault for housing same, additional fire hydrants, valves, fittings, etc. $32,727. O. A. Pluskey, Blaw-Knox engr. Noted Oct. 22, C. D.—Oct. 24, E. N.-R.

†**Pa., Carlisle**—Jan. 22, by Con. Q.M., Carlisle Barracks, constructing and completing 200,000 gal. elevated steel tank.

Tex., Orange Grove—City, A. Wendt, mayor, taking bids waterworks, incl. 75 ft. 100,000 gal. elevated steel tank and tower, two pumps, water well, 18,000 ft. 4- to 6-in. c.i. mains, $46,000. P.W.A. project. H. R. F. Helland, 1020 Frost Bldg., San Antonio, engr. Noted Sept. 5, C. D.—Sept. 12, E. N.-R.

CONTRACTS AWARDED

Calif., Dos Palos—City Council, water system, filter and purification systems together with distributing system, to P. L. Burr, 320 Market St., San Francisco, $58,620. Est. $65,000. Bids Nov. 25, awarded Dec. 31. Noted Dec. 6, C. D.—Oct. 17, E. N.-R.

★ **Calif., Los Angeles** — Metropolitan Water Dist., 306 West 3rd St., Colorado River Project, Spec. 137 Schedule 1-P, 2.33 mi. 11 ft. 8 in. precast concrete pipe and Schedule 3-P, 3.81 mi. 11 ft. 8 in. precast concrete pipe to Americus Concrete & Steel Pipe Co., 4635 Firestone Blvd., Southgate, $540,611 and $880,639 respectively•••Schedule 2-S, 10.33 mi. 9 ft. 8 in. to 12 ft. steel pipe and Schedule 2-B, Santa Ana River Bridge, to Western Pipe & Steel Co., 5717 Santa Fe Ave, $4,047,374 and $159,663 respectively. Grand total $5,628,287. Bids Jan. 7, awarded Jan. 10. Noted Dec. 9, C. D.—Dec. 12, E. N.-R.

Conn., New London—City, 30 in. watermain Looping Swamp in Waterford Sect., to N. Benvenuti & Sons, 16 Elm St., $34,454. Bids Dec. 12. Noted Dec. 27, C. D.—Dec. 5, E. N.-R.

Fla., Fort Lauderdale — City, constructing 500,000 gal. water storage tank, to Tippett & Wood, Phillipsburg, N. J. **P.W.A.** Noted Dec. 3, C. D.—Dec. 5, E. N.-R.

Ga., Lexington—City, waterworks, to Hombuckle & Cole, Atlanta, $22,477. Est. $25,454. **P.W.A.** Noted Nov. 22, C. D.—Nov. 28, E. N.-R.

Ga., Milan — City, addition to city waterworks, to Gray & Stevens, 554 Forest Ave., Jacksonville, Fla., $13,991. Est. $22,700. **P.W.A.** Noted Nov. 1, C. D.

Ga., Omega—City, constructing one deep well for water supply, to Gray Stevens, Jacksonville, $2,071. Est. $2,500. **P.W.A.** Noted Nov. 1, C. D.

Ga., Savannah—City, A. S. Goebel, engr., c/o City Hall, brick pump house and c.i. mains, to Layne Atlantic Co., New Monroe Bldg., Norfolk, Va., $43,909. Est. $40,000. **P.W.A.** Bids Nov. 14. Noted Nov. 8, C. D.

Kan., Pittsburg—City, waterworks improvements, general contract for buildings, to Grimshaw Constr. Co., Philcade Bldg., Tulsa, Okla., $110,840; chimney, to Rust Eng. Co., 6 North Michigan Ave., Chicago, Ill.•••crane, to Darby Constr. Co., Kansas City, Kan. **P.W.A.** Noted Oct. 15, C. D.—Oct. 17, E. N.-R.

Ky., Tinton—Municipality, waterworks, 50,000 gal. elevated water tank, to Pittsburgh-Des Moines Steel Co., Neville Island, Pittsburgh, Pa.

Mass., Holyoke—Holyoke Water Power Co., 1 Canal St., furnishing steam generating equipment, to Riley Stoker Corp., 27 State St., Boston. Noted Dec. 17, C. D.

Mass., New Bedford—At office New Bedford Water Bd., Municipal Bldg., cleaning and lining 42,600 ft. 48 in. diam., riveted steel water pipe in place, in Rochester, Freetown and Dartmouth, to Tucker Constr. Co., Inc., 348 Washington St., Providence, R. I. $132,912. **P.W.A.** Bids Nov. 19, awarded Jan. 3. Noted Nov. 22, C. D.—Nov. 7, E. N.-R.

Mass., Reading—Tuller Constr. Co., general contractor, Red Bank, N. J., heating for waterworks, to Lumsden & Van Stone Co., 426 First St., South Boston, for Town, H. W. Putnam, chn. Bd. P. Wks., Municipal Bldg.•••electrical work, to MacFarlane & Abbott, 46 Cornhill, Boston•••structural steel erection, to W. G. Morgan, 129 Garland St., Everett. Noted Nov. 4, C. D.—Nov. 7, E. N.-R., under "Contracts Awarded."

Mich., Clifford—C. Friday, village clk., constructing well for village water supply, to Ohio Drilling Co., Massillon, O., $1,698. **P.W.A.** Bids Nov. 15. Noted Nov. 7, C. D.—Apr. 4, E. N.-R.

Mich., Tawas City—W. C. Davidson, city clk., constructing well for water supply, to E. Christman, Tawas City, $2,281. **P.W.A.** Bids Nov. 19. Noted Nov. 7, C. D.—Nov. 14, E. N.-R.

Mo., Rolla—Missouri School of Mines & Metallurgy, C. H. Fulton, dir., deep well, to Virginia Machine & Well Co., Richmond, Va., $8,065. **P.W.A.** Bids Dec. 3. Noted Sept. 3, C. D.—Sept. 5, E. N.-R.

Mont., Glasgow—City, improving water system, incl. pre-poured and pre-caulked Class 150 c.i. pipe, to E. Johnson, Glasgow, Glasgow, $20,126. **P.W.A.** Bids Dec. 28, awarded Dec. 28. Noted Dec. 19, C. D.

N. H., Milton—Town, Fire Dist. Comrs., Town Hall, water supply system, to Ames Constr. Co., Somersworth, approximately $44,000. **P.W.A.** Bids Nov. 30. Noted Dec. 9, C. D.—Nov. 14, E. N.-R.

N. Y., Carmel—Town, water system in Mahopac Hills Section, to Amoriello & Son, 102 Washington Pl., White Plains. Est. $50,000. **P.W.A.** Noted Dec. 19, C. D.—Dec. 12, E. N.-R.

N. Y., Oswego—City, new centrifugal pump for pumping station, to Kingsford Fdry. & Machine Co., Oswego, $2,244; electric motor, switches, etc., for operating pump, to Snyder & Mackin Co., Oswego, $3,125. Bids Dec. 12. Noted Dec. 11, C. D.

N. Y., Syracuse—New York Central R. R. Co., J. W. Pfau, ch. engr., 466 Lexington Ave., New York, furnishing, installing two 50,000 gal. steel water tanks in connection with grade crossing elimination project, to Chicago Bridge & Iron Co., 165 Bway., New York.

N. C., Wake Forest—Town, constructing waterworks system, to W. E. King, Durham, $29,502. **P.W.A.** W. M. Pratt, Durham, engr.

N. D., Bowbells—City, waterworks system, to Huston & Mackley, Minot, $25,843. **P.W.A.** Bids Dec. 2. Bids Nov. 2 rejected. Noted Nov. 1, C. D.

O., Akron—City, concrete water supply conduit, to Connelly Bros., 2nd Natl. Bank Bldg., Cincinnati, $60,830. **P.W.A.** Noted Jan. 3, C. D.—Jan. 9, E. N.-R.

O., Alger—City, waterworks system, Contr. 1, general section, to J. C. O'Brien, 214 West Grand Ave., Lima, $48,186. **P.W.A.** Noted Sept. 1, 1933, C. D.—Sept. 7, 1933, E. N.-R.

O., Bloomdale — City, waterworks system, Contr. 2, general section, to C. D. Mitchell, Carey, $36,626. **P.W.A.** Noted Sept. 27, C. D.—Jan. 2, E. N.-R.

★ **O., Cincinnati**—City, constructing chemical building and coagulation basins and all work in connection at water purification plant, incl. 13,000 lin.ft. concrete piling, 21,370 cu. yd. concrete, 1,406 tons reinforcing steel, to Penker Constr. Co., 1030 Summer St., $942,517. Est. $800,000. **P.W.A.** Noted Dec. 19, C. D.—Dec. 26, E. N.-R.

O., Danville — Village, constructing waterworks system, Contr. 1, general section, to M.

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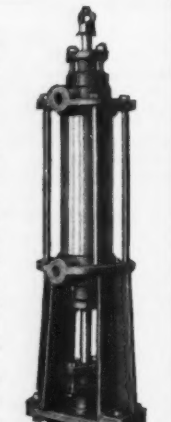

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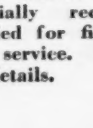

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Waterworks (Continued)

Fatol, 3553 East 103rd St., Cleveland, $38,104. **P.W.A.** Noted Aug. 30, C. D.—Sept. 5, E. N.-R.

O., Kenton—City, constructing new waterworks system, to Uncapher & Gillespie Co., Marion, $43,000. Est. $45,000. **P.W.A.**

O., Mansfield—City, general contract water-mains, to G. B. Herring & Son, 419 West 3rd St., $54,126. **P.W.A.**

O., Mt. Vernon—City, general contract water softening plant, Contr. 1, to Couse & Sanders, 415 Brainard St., Detroit, Mich., $61,751. **P.W.A.**

O., Mt. Victory—City, general contract, constructing waterworks system, Contr. 1, to Uncapher & Gillespie, LaRue, $3,821***Contr. 2, to Pittsburgh-Des Moines Steel Co., Neville Island, Pittsburgh, Pa., $9,867***Contr. 3, to J. E. O'Brien, Lima, $24,512. Grand total $38,200. **P.W.A.** Noted Sept. 20, C. D.—Sept. 26, E. N.-R.

O., Painesille—City, constructing water lines, to Martin Valochi, 352 Sanford Ave., $37,000; 1 m.g. rein.-con. reservoir, to C. W. Jackson Co., 11717 Phillips Ave., $24,191. **P.W.A.** Noted Dec. 31, C. D.—Jan. 9, E. N.-R.

O., Seville — City, waterworks, 50,000 gal. elevated steel storage tank, 127 ft. high, water distribution lines, to G. A. Hickey, Inc., Prospect Fourth Bldg., Cleveland, $57,517. **P.W.A.** Noted Dec. 18, C. D.—Dec. 26, E. N.-R.

O., Taylorville—City, constructing waterworks system, Contr. 1, general section, to R. E. Getz, Baltic, $49,528. **P.W.A.**

Pa., Pittsburgh — Allegheny Co. (Pittsburgh), improving water supply for North Park, Contr. 1, filtration plant and appurtenances, McCandless Twp., to E. H. Dobson, 145 Westland Dr., Pittsburgh, $78,558***Contr. 2, electrical work, to Star Electric & Constr. Co., 117 Flowers Ave., Pittsburgh, $7,470*** Contr. 3, plumbing work, to Weldon & Kelly Co., 1801 Locust St., Pittsburgh, $1,375***Contr. 4, heating, to G. F. Higgins Co., Wabash Bldg., Pittsburgh, $2,650 ***Contr. 5, standpipe, to Pittsburgh-Des Moines Steel Co., Neville Island, Pittsburgh, $22,825***Contr. 6, water lines, to Parkview Constr. Co. 4, Boundary St., Pittsburgh, $52,430. Grand total $164,308. Noted Jan. 9, C. D. —Dec. 19, E. N.-R.

S. D., Edgemont—City, waterworks system, incl. drilling and 3,100 ft. well, to C. C. Miller, Belle Fourche, $35,960. **P.W.A.** Bids Dec. 12. Noted Dec. 27, C. D.

Tex., Alamo—City, c/o G. L. Jones, mayor, waterworks improvements, mechanical filter plant, extension to watermains, to Briggs-Darby Constr. Co., Pharr, $55,026. Est. $65,000. **P.W.A.** Bids Dec. 13. Noted Nov. 29, C. D.—Dec. 5, E. N.-R.

Tex., Annona—City, c/o E. P. Gaines, mayor, constructing waterworks, incl. well, distribution system, fire hydrants, meters, pumps, to Klein & Lowe Constr. Co., 4617 Live Oak St., Dallas, $30,913 est. $37,000***steel tank and tower, to Pittsburgh-Des Moines Steel Co., Praetorian Bldg., Dallas, $5,400***pump house, to A. E. Anderson, Clarksville, $1,184. Grand total $37,497. Est. $37,000. **P.W.A.** Bids Nov. 4. Noted Nov. 15, C. D.—Oct. 4, E. N.-R.

Tex., Haskell — City, c/o A. F. Thurman, mayor, waterworks, incl. c.i. distribution extensions, 10,525 ft. 6" in. and 5,050 ft. 8 in. pipe, fire hydrants, chlorinator, pump house, pumps and pumping equipment, rein.-con. reservoir elevated tank, to Vedder Constr. Co., Childress, $31,187. **P.W.A.** Bids Oct. 29, awarded Dec. 22. Noted Nov. 7, C. D.—Oct. 17, E. N.-R.

Tex., Madisonville—City, R. L. Hardy, mayor, waterworks extension, incl. watermains, fire hydrants, meters, to C. F. Lytle, 504 Nebraska St., Sioux City, Ia., $35,258; 100,000 gal. elevated steel tank and 75 ft. steel tower, to Chicago Bridge & Iron Wks., 2919 Main St., Houston, $7,075. **P.W.A.** Bids Dec. 6. Noted Dec. 17, C. D.—Oct. 31, E. N.-R.

Tex., Tioga—City, c/o J. F. Smith, mayor, constructing well, pumps, pumping station and c.i. distribution system, to E. L. Dalton, Natl. Bank Bldg., Dallas, $22,685. Est. $25,000. **P.W.A.** Bids Nov. 12, awarded Dec. 27. Noted Nov. 22, C. D.—Oct. 31, E. N.-R.

Wis., Oshkosh — City, plant equipment for water purification plant addition, to Thomas Heating Co., Racine, $19,520. **P.W.A.** Bids Dec. 13. Alvord, Burdick & Howson, Chicago, Ill., engrs.

Wis., Oshkosh—City, filter plant additions, to C. R. Meyer & Sons Co., Oshkosh, $24,813 ***plant equipment, to Pittsburgh-Des Moines Steel Co., 38 South Dearborn St., Chicago, Ill., $49,900***tank foundations, to P. Rasmussen & Sons, Oshkosh, $4,788***mixing equipment, to Dorr Co., Inc., 221 North LaSalle St., $695 ***mixing equipment and granular carbon, to International Filter Co., 59 East Van Buren St., Chicago, Ill., $1,908 and $5,994 respectively. Grand total $88,098. **P.W.A.** Bids Dec. 13. Noted Dec. 6, C. D.—Dec. 12, E. N.-R.

SEWERAGE AND WASTE DISPOSAL

PROPOSED WORK

Calif., San Fernando—City plans sanitary sewers in Griswold Ave. from 4th St. to 6th Sts. and in part of Newton and Maclay Sts. $25,000. H. E. Waite, City Hall, engr. City applied for W.P.A. funds in amount of $25,000 to finance construction.

Conn., Portland — Town preliminary plans sewage disposal facilities. $80,000. P.W.A. project. N. L. Germain, 135 Liberty St., Middletown, engr. Noted Dec. 30, C. D. — Jan. 2, E. N.-R.

Kan., Parsons—City Clerk rejected bids Nov. 26, constructing sewage disposal plant addition. $80,000. Will readvertise. Black & Veatch, 4706 Bway., Kansas City, Mo., engrs.

Kan., Topeka—City rejected bids Dec. 13, constructing sewage disposal plant. Will readvertise. Chas. A. Haskins & Co., 317 Finance Bldg., Kansas City, Mo., engrs. Noted Dec. 3, C. D.—Dec. 5, E. N.-R.

Mass., Rockland—Town, H. Torrey, chn. Bd. Selectmen, Town Hall, plans sewerage system. Engineer not appointed.

Minn., Northfield—City rejected bids Dec. 20, constructing sewage disposal plant. $100,000. Project abandoned. Pillsbury Eng. Co., 1209 2nd Ave. S., Minneapolis, engrs. Noted Dec. 6, C. D.—Dec. 12, E. N.-R.

Mo., Overland—Overland Sanitary Sewer Dist. withdrew bids to have been opened Dec. 7, constructing 159,600 ft. 8- to 27-in. vit. clay sewers, sewage treatment plant with equipment, piping and appurtenances. Bonds defeated. Project abandoned. Kinsey Eng. Co., 20 South Central Ave., Clayton, engrs. Noted Dec. 5, C. D.

Neb., Lawrence—City plans sewerage system. $34,545. P.WA.. allotment approved. H. A. Davis, Crete, engr. Noted Sept. 25, C. D.—Oct. 3, E. N.-R.

Neb., Peru—City plans sewers and sewage disposal plant. $47,272. P.W.A. allotment approved. H. A. Davis, Crete, engr. Noted Sept. 25, C. D.—Oct. 3, E. N.-R.

New Jersey — State Bd. Health, Trenton, ordered Sea Girt Council to construct sewage disposal system by May 31. G. Roland Moore, 19 Morris Ave., Manasquan, engr.

N. Y., Albany—City plans straightening Arch St. sewer and rerouting dam through Warren St. $195,721. $88,074 P.W.A. grant allotted. J. J. McManus, city engr.

N. Y., Middletown—City plans sewage disposal plant addition in Goshen State Rd. To exceed $23,000. Engineer not appointed.

N. Y., Oneonta—City plans storm sewers in Main and North 6th Sts. in Wellman Tract. $23,000. Will apply for federal funds and owner will purchase materials.

N. Y., Pittsford—Village will not construct sanitary sewerage system. $287,000. Project voted down. Future indefinite. W. S. Lozier, Inc., 10 Gibbs St., Rochester, engrs. Noted Sept. 16, C. D.—Sept. 19, E. N.-R.

N. Y., West New Brighton—Dpt. Sanitation, T. W. Hammond, comr., Municipal Bldg., rejected bids Dec. 12, demolishing present brick lining and constructing new fire brick lining in chimney at incinerator here. Noted Dec. 13. C. D.

N. Y., West Phoenix—Village plans sewers and sewage disposal plant. $25,000.

N. C., Andrews—See "Waterworks."

N. C., Colerain—See "Waterworks."

N. C., Vanceboro—See "Waterworks."

O., Ashland—City, plans sanitary sewers in north section city where development has been retarded by lack of sewers, extension in score of streets, $35,000. Council appropriated $35,000 from general fund for project. E. M. Kerr, Ashland, engr.

O., Cleveland—City and Industrial Rayon Co., c/o H. Rivitz, pres., West 58th St. and Walford Ave., making plans sewer line from West 98th St. and Walford Ave. to westerly sewage disposal plant at West 58th St. $200,000. R. Hoffman, city engr.

O., Mansfield — City completing plans constructing sewer lines, pumping equipment and buildings of sewage disposal plant, P.W.A. project. G. B. Somers, 1836 Euclid Ave., engr. Noted Oct. 21, C. D.—Oct. 24, E. N.-R.

Pa., West Middlesex—Boro Council applied to W.P.A. for funds to construct municipal sewage disposal plant. $25,000. Boro will provide $10,000 toward cost. Boro Engineer, engr.

Wash., Ellensburg — City plans sewage disposal plant, 4,000 ft. from city limits and trunk sewer to city limits, $200,000. L. R. Stockman, Baker City, Ore., engr.

★ **Wash., Tacoma** — City plans constructing trunk sewers, Comr. A. R. Bergersen proposes to Chamber of Commerce that city ask $3,000,000 for same. C. D. Forsbeck, City Hall, engr. Noted Mar. 20, C. D.—Mar. 22, E. N.-R.

Wis., Clear Lake—City making plans constructing sanitary sewer plant, about 17,000 ft. sewers, primary and secondary treatment plant. $40,000. Banister Eng. Co., 556 North Prior St., St. Paul, Minn., and Hudson, Wis., engrs.

Ont., Galt—Town, J. McCartney, clk. making plans new sewerage disposal works.

BIDS ASKED

Calif., Long Beach — See "Contracts Awarded."

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†*Federal Government.*

sewerage, etc. (Continued)

Calif., Huntington Beach—Jan. 27, by City, rein.-con. sewage treatment plant, vitrified pipe outfall, miscellaneous piping and pumping equipment. $22,000. Currie Eng. Co., Andreson Bldg., San Bernardino, engrs. Noted Dec. 23, C. D.—Dec. 26, E. N.-R.

Conn., Middletown—Jan. 24, by City, R. Mylchreest, P. Wks. Dpt., Contr. 3, South Interceptor and furnishing sewer and sewage plant equipment. P.W.A. project. T. F. Bowe, 110 William St., New York, engr.

Conn., Middletown — Feb. 21, by R. Mylchreest, P. Wks. Dpt., constructing sewage disposal plant, River Rd., Contr. 4. T. F. Bowe, 110 William St., New York.

Ill., Waukegan—Jan. 31, by North Shore Sanitary Dist., J. Oliver, pres., sewage treatment plant. Greeley & Hansen, 6 North Michigan Ave., Chicago, engrs. P.W.A. project.

Ill., Wyanet—Jan. 27, by Village Bd., R. R. Kermeen, pres., constructing sewerage project. $50,000. J. A. Harman, Peoria, engr.

Ky., Louisville—Feb. 11, by Comrs. Sewage Mill Creek Main Sewer, E.R.A. Project 14, Contr. 91, incl. 3,026 lin.ft. 11 ft. 8 in.x17 ft. 6 in., and 3,706 lin.ft. 9 ft.x13 ft. 6 in. rein.-con. inverted egg sewer, 1,900 cuyd. rock excav., 13,880 cu.yd. rein.-con., 2,454,000 lb. steel reinforcing bars. W. M. Caye, technical engr.; adv. E. N.-R., Jan. 16.

Mich., Detroit—Jan. 24, by Dpt. P. Wks., 104 City Hall, Sect. 10, Detroit River Interceptor, Jefferson Ave. from Military to Scotten Ave., P.W.A. Docket 9602. J. S. Stringham, city engr. L. G. Lenhardt, comr. P. Wks.

Minn., Fergus Falls—Jan. 24, by City, B. M. Lein, clk., sewage disposal plant, interceptor sewer and 2,000 lin.ft. tunnel work. P.W.A. project. Pillsbury Eng. Co., 1200 2nd Ave. S., Minneapolis, engrs. Noted Jan. 6, C. D.—Jan. 9, E. N.-R.

Mo., St. Louis—Feb. 4, by Bd. P. Serv., City Hall, 820 ft. 72 in. sewer in open cut and about 115 ft. 72 in. sewer in tunnel, incl. manholes, outlet structures and necessary appurtenances, etc., Sect. B, drainage for Riverview Dr. between Valley Dr. and Lookaway Dr. $27,000. P.W.A. project. L. A. Pettus, city engr.

Ore., Oswego—Jan. 27, by City Council, constructing sewerage system, incl. 3 trunk sewers and branches converging at outfall, 65,000 lin.ft. concrete or vitr. clay pipe and 231 manholes.

CONTRACTS AWARDED

Calif., Long Beach—City, constructing Bennett Ave. storm drain, $161,333***extensions to South Branch Sanitary Sewer Interceptor (2 projects) $19,944 and $19,738***Silverado Park storm drain extensions, $14,053 and $11,239, by W.P.A. labor. Grand total $226,007. J. W. B. Blackman, City Hall, engr. R. M. Dorton, city mgr.

Colo., Denver—City and Denver Co., City and County Bldg., equipment for use in proposed sewage disposal works, Item 1, to Chain Belt Co., $5,980***Items 2 and 6, to Link Belt Co., $6,570 and $16,166 respectively***Item 3, to Dorr Co., Cooper Bldg., $32,270***Item 4, to D. E. Kepner, 1921 Blake St., and Pacific Flush Tank Co., $44,186***Item 5, to Chicago Pump Co., $3,219***Item 7, to Wallace & Tiernan, $5,960. All above firms nationally known with Denver representatives. Grand total $114,351. Noted Nov. 27, C. D.—Dec. 5, E. N.-R.

Conn., Middletown—City, constructing North Interceptor and appurtenances, Contr. A 1, to Inter-County Constr. Corp., Rye, New York, $75,013. **P.W.A.** Bids Dec. 27, awarded Jan. 6. Noted Jan. 8, C. D.—Oct. 17, E. N.-R.

Ga., Macon—City, c/o H. I. Smart, mayor, constructing incinerator, to Nye Odorless, Inc., Macon, $45,400. Est. $45,000. **P.W.A.** Bids Dec. 13, awarded Dec. 23. Noted Dec. 9, C. D.

★ **Ill., Chicago**—Sanitary Dist., excavating and constructing 2 mi. concrete sewer in South Park Ave., to Underground Constr. Co., 130 North Wells St., $1,213,058; 1 mi. sewer in Cherry St., to Marsch Constr. Co., 1307 Wrightwood Ave., $291,175. W. H. Trinkaus, 910 South Wabash Ave., engr.

Mass., Boston—City, Dpt. P. Wks., C. J. Carven, comr., City Hall Annex, concrete sewerage lines in B and 7th Sts., South Boston, to N. Cibotti, 15 Page St., Hyde Park, Boston, $20,361. Bids Dec. 27, awarded Jan. 3.

Mass., Medford—Commonwealth of Massachusetts, Metropolitan Dist. Comn., 20 Somerset St., Boston, constructing Sect. 108 North Metropolitan Relief Sewer, to C. & R. Constr. Co., 75 Bradeen St., Roslindale, $169,220. **P.W.A.** Bids Jan. 3, awarded Jan. 7.

Mich., Ludington—D. Thompson, city clk., constructing Contr. 1, 9,000 ft. 10- to 24-in. intercepting sewers with auxiliary structures, to Chalmers Paving Co., Grand Rapids, $64,593. **P.W.A.** Bids Dec. 2. Noted Dec. 12, C. D.—Nov. 21, E. N.-R.

Mo., Cape Girardeau—City, constructing outlet and lateral sewers in various streets, to E. L. Markham, Cape Girardeau, $47,313 and $53,382 respectively. **P.W.A.** Bids Dec. 2. Noted Dec. 16, C. D.—Oct. 24, E. N.-R.

Neb., Crawford—City, sewage disposal plant, Sect. A, Item 4, to Chambers-Constr. Co., Lincoln, $374. Total est. $25,465. **P.W.A.** Bids Dec. 7. Noted Aug. 12, C. D.—Aug. 15, E. N.-R.

‡Federal Government.

N. Y., Brooklyn—R. V. Ingersoll, pres. Brooklyn Boro. Boro Hall, to E. Meluccio, 1209 61st St., sewers in Mansfield Pl., $6,187; in Village Rd. South, $2,332***to Flushing Contg. & Eng. Co., 66 Wyoming Ave., in Crawford Ave., $4,341***to S. Della Salla, 11-45 59th St., in East 51st St., $2,936; in Crawford Ave., $2,303; in East 89th St., $5,838. Grand total $23,937. Bids Dec. 18. Noted Dec. 19, C. D.—Dec. 12, E. N.-R.

N. Y., Brooklyn—R. V. Ingersoll, pres. Brooklyn Boro, repairing mechanical equipment for subsidiary pumping station, Neptune Ave., to McHarg Co., Inc., 1328 Bway., $8,840. Bids Dec. 23. Noted Dec. 26, C. D.—Dec. 19, E. N.-R.

N. Y., Elmira—F. A. Canuso & Son, general contractors, 704 South 17th St., Phila., Pa., reinforcing steel for sewage disposal plant, for City, to Taylor-Davis, Inc., 4250 Wissa Ave., Phila., Pa. **P.W.A.** Noted Dec. 23, C. D.—Dec. 26, E. N.-R., under "Contracts Awarded."

N. Y., Lockport—City, City Hall, two 40 ton incinerator units with individual preheaters, to DeCarie Incinerator Co., 155 East 44th St., New York, $51,800. Est. $52,000. **P.W.A.** Bids Dec. 9. Noted Jan. 3, C. D.—Jan. 9, E. N.-R.

N. Y., Newfane—Village, sewers and sewage disposal plant, to Reiffer Bros., 44 Westview Ave., Hamburg, $75,000 and $25,900 respectively. Est. $146,231. **P.W.A.** Bids Dec. 11. Noted Dec. 19, C. D.

N. Y., Stella—Town, constructing sewerage system, to C. Rose, 257 Main St., Johnson City. Est. $60,000. **P.W.A.** Noted Dec. 10, C. D.—Dec. 12, E. N.-R.

O., Akron — City, constructing Euclid Ave. Relief Sewer, to DeLuca Constr. Co., 245 Annadale Ave., $28,663. **P.W.A.**

O., Chillicothe—Director Public Service, for North Interceptor Sewer, rein.-con. construction, Sect. A-1, to Boyd & Cook, Union Trust Bldg., Dayton, $55,496***North Interceptor Sewer, rein.-con. construction, Sect. A-2 of Contr. A, to C. J. Wetzel, 1260 Herbein St., Dayton, $78,749***sewage disposal system, Contr. C, to W. E. Wood Co., 4649 Humbolt, Mich., $170,700 est. $155,000 plus***South Interceptor Sewer, Contr. B, incl. 7,895 ft. 27 and 30 in. rein.-con. pipe, and 1,082 ft. 6- to 12-in. vitr. clay pipe, to Drainage Constr., Inc., 14375 Schaefer St., Detroit, Mich., $73,309 est. $90,000 plus. Grand total $378,254. **P.W.A.** Noted Dec. 25, C. D.—Dec. 26, E. N.-R.

O., Columbus—City, Beulah Rd. Dist. sanitary sewers, laterals, Part 4, Contr. 60, general section, to Columbus Constr. Co., 369 Clinton Heights Ave., $44,889. **P.W.A.**

O., Columbus—City, relief, sanitary and storm sewers, Contr. 55, Hudson St. Dist. Storm Sewer, Part 3, general contract, to Boyd & Cook Co., Dayton, $37,379. **P.W.A.**

O., Georgetown — Village, general contract, Contr. 1, treatment plant, to J. C. Love, Sidney, $27,630; Contr. 2, sewer, to Nickles Bros. & J. Pandoli, 1522 14th St., Canton, $44,793. **P.W.A.** Noted Dec. 9, C. D.

O., Lockland — Village, J. Barstow, mayor, constructing brick, concrete garbage incinerator and necessary appurtenances, to Pittsburgh-Des Moines Co., Neville Island, Pittsburgh, Pa., $30,230. Est. $25,000. **P.W.A.** Noted Dec. 30, C. D.—Jan. 2, E. N.-R.

O., Massillon—City, sewage disposal plant, to E. D. Vogt Paving Co., 846 Williamson Ave., $330,825. **P.W.A.** Noted Jan. 2, C. D.—Jan. 6, E. N.-R.

Pa., Pittsburgh — City, constructing relief sewer in Maurice St., to M. Mannella, Oliver Bldg., $55,890***sewers in Fair Oaks St., to V. Mannella, 6300 Edby St., $720***in Otis Way, to Kelly Constr. Co., Boquet St., $060***in West Prospect Ave., to D. Carapellucci Co., 130 Maytide St., $3,683***heating system in Garden Center House, to Howe Heating Co., 1626 Bway., $1,448***expansion ramps on Blvd. of the Allies, to Fort Pitt Bridge Wks., Oliver Bldg., $13,185***bridge over Pittsburgh Junction R.R., Forbes St., to Farris Eng. Co., Empire Bldg., $2,975. Grand total $78,561.

R. I., Providence—City, F. Nolan, city engr., Dpt. P. Wks., City Hall, Contr. 4-A, sewage disposal plant addition and alterations, at Fields Point, to Tucker Constr. Co., Inc., 346 Washington St., $70,000; air blowers, filters and general equipment, to Roots-Connersville Blower Corp., 24 State St., New York, $83,000. **P.W.A.** Noted May 8, C. D.—May 2, E. N.-R.

Tex., Palestine—City, H. F. Handorf, mayor, sewage disposal plant, incl. 3,500 ft. 24 in. vitr. clay outfall line connecting lines with hookups, 66 ft. Imhoff tank, 43 ft. wide, 33 ft. deep, 4 sludge beds, 40x50 ft., 2 scum beds, 10x50 ft., 3 dosing tanks, etc., to Ben Sira & Co., 3101 Elm St., Dallas, and Palestine, $83,651. Est. $100,000. **P.W.A.** Bids Dec. 12. Noted Dec. 23, C. D.—Nov. 7, E. N.-R.

Tex., Temple—City, c/o W. S. Sealey, mayor, 3.5 mi. sanitary sewers, to Whittle Constr. Co., and J. P. Williams, Dallas, $62,456. **P.W.A.** Bids Dec. 27. Noted Dec. 17, C. D.—Dec. 19, E. N.-R.

Tex., Whitney — City, c/o V. B. Fowler, mayor, complete sanitary sewerage system, incl. collecting mains, manholes, cleanouts and disposal plant, 14,080 ft. 4- to 8-in. vitr. clay pipe, to McKenzie Constr. Co., 1100 West Commerce St., Dallas, and Smith-Young Tower,

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Sewerage, etc. (Continued)

San Antonio, $26,300 (tentative award). Est. $30,000. **P.W.A.** Bids Dec. 13. Noted Dec. 27, C. D.

Utah, Tooele—City, extending 3,000 ft. 8 in. tile to present sewerage system on 2nd West St., from 1st North St. to 3rd South St., by **W.P.A.**, on day labor basis. $24,465. J. D. Gollaher, city engr.

Man., Winnipeg — City Council, sewers in Mission St. and Jessie Ave., to Dominion Constr. Co., 551 College Ave., $49,875***44 in. secondary sewer in Sutherland Ave., to Carter Halls, Aldinger Co., Royal Bank Bldg., $99,895*** secondary sewers in Boyle and Alexander Aves., to Henry Borger & Son, 414 Church Ave., $43,484. Grand total $193,254.

BRIDGES AND GRADE CROSSINGS

PROPOSED WORK

★ **Connecticut**—State Hy. Dpt., J. A. Macdonald, comr., State Office Bldg., Hartford, making plans constructing rein.-con. bridges and underpasses, for grade crossing elimination, as follows: reconstruction of grade crossing, Southbury, $50,000; grade crossing, Wallingford, $140,000; Avon, Canton and Windsor Sts., Hartford, $350,000; relocation Route 14, Simsbury, $100,000; U. S. Route 5-A, New Haven, $133,000; U. S. Route 1, Kings Hy., Fairfield, $314,000; separation structure, Routes 15 and 22, Canaan, $100,000, all foregoing on New York, New Haven & Hartford R.R.; repairing Route 18, Norwich, $150,000; Route 9, Willimantic, $250,000; Norwich Project on Central Vermont R.R., Willimantic, is separation project, Central Vermont and New Haven Railroads. Total est. $1,587,000. Federal funds for entire cost.

Conn., Fairfield—State Hy. Comn., State Office Bldg., Hartford, and Fairfield Co. takes bids this month, rein.-con. hy. bridge at Kings Hy. Cut-off, $315,000. J. A. Macdonald, State Office Bldg., Hartford, hy. comr.

Neb., North Platte—City plans constructing viaduct over Union Pacific R.R. tracks, here, $100,000. J. Noske, city engr. A. M. Gaddis, assistant state engr. Government approved plans.

★ **N. Y., Buffalo**—Buffalo Grade Crossing & Terminal Comn., D. J. McKenzie, secy., City Hall, and seven railroads, bids about Mar. 15, constructing 1,600 ft. steel, concrete viaduct over tracks at Tifft St. $1,000,000. A. H. Williamson, city engr. Noted Sept. 25, C. D.—Oct. 3, E. N.-R.

Texas—State and Limestone Co. soon take bids constructing large concrete, steel overpass, Milam St., Mexia. $140,000. O. Seaward, Jr., Mexia, engr.

Washington—State Hy. Dpt., Olympia, making plans bridge over Crooked Creek in Skamokawa; bridge over Snake River between Lewiston, Idaho, and Clarston, Wash. L. V. Murrow, hy. engr.

Wis., Racine—City making plans constructing bridge. $60,000. P.W.A. grant applied for. Klug & Smith, 111 East Wisconsin Ave., engrs.

Man., St. Vital—Municipality making plans constructing bridge across Red River at Oslorne St., contingent upon receiving grant from Provincial Govt.

BIDS ASKED

Ill., Freeport—Jan. 24, by Dpt. P. Wks. & Buildings, Div. Hys., constructing 3 span continuous steel I-beam bridge on Sect. 13B and C MFT., Stephenson Co. G. H. Baker, engr. co. roads and city streets.

Louisiana—See "Streets and Roads."

Maryland—Jan. 21, by State Roads Comn., Baltimore, single 42 ft. span, steel girder bridge, encased in concrete, etc., carrying tracks of Cumberland and Penna. R.R. over state hy. at Winchester, Contr. A-178-1-621, F.A.P. W.P.G.S. 402, Allegheny Co.; single 50 ft. span, steel girder bridge encased in concrete with reconstructed concrete substructure, carrying tracks of W. M. R.R. over state hy. at Thurmont, Contr. F-263-1-521, W.P.G.M. 173-B, Frederick Co.

N. Y., Glendale—Jan. 31, by Transit Comn., 270 Madison Ave., New York, constructing grade crossing elimination at 80th St. (Dry Harbor Rd.), on Montauk Division of Long Island R.R. Co., Queens Boro.

Ohio—Jan. 28, by J. J. Jaster, Jr., Ohio Hy. Dir., Columbus, constructing 68 ft., 85 ft. and 68 ft. span concrete bridge with steel beams, incl. 490 cu.yd. excav. for structure, 530 cu. yd. channel excav., 50,500 lb. reinforcing steel, 267,000 lb. structural steel, Logan Co. $80,369.

★ **Pa., Pittsburgh**—Jan. 21, by Allegheny Co. Authority, County Office Bldg., constructing 7 piers, Nos. 1 to 7 (inclusive) Highland Park toll bridge, Contr. 401, construction and erection of superstructure of main spans and north approach, Contr. 402. Approximately $3,000,000. E. L. Schmidt, County Office Bldg., engr.

Texas—State and Limestone Co. taking bids five 80 to 140 ft. rein.-con. and steel bridges on Coolidge-Meinger Rd. $200,000. O. A. Seaward, Jr., Mexia, engr.

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CONTRACTS AWARDED

†**Alabama**—U. S. Eng., Mobile, constructing additional span in bridge over Caloosahatchee River, to Hardaway Constr. Co., Columbus, Ga., $27,675. Bids Dec. 11.

Arkansas—State Hy. Comn., Little Rock, 961 ft. rein.-con. deck girder bridge on Cammen-Bearden Rd., Ouachita Co., to Dixon and Dixon, Warren, $45,027. W. W. Zass, Little Rock, hy. engr.

California — State Hy. Comn., Sacramento, constructing overcrossing over tracks of Atchison, Topeka & Santa Fe R.R., at Calva, Fresno Co., to R. R. Bishop, 5017 East Bway., Long Beach, $184,768. Bids Dec. 4, awarded Dec. 16. Noted Dec. 13, C. D.—Nov. 28, E. N.-R.

★ **California**—State Hy. Comn., Sacramento, constructing grade separation under tracks of Southern Pacific Co., Kern Co., to Griffith Co., Railway Bldg., Los Angeles, $295,611*** undergrade crossing under tracks of Southern Pacific R.R. and Western Pacific R.R. Co., at Charter Way, Stockton, San Joaquin Co., to Biasotti-Willard and Biasotti, 40 West Clay St., Stockton, and Rocca Co., Box 444, San Rafael, $267,421, joint bid***undergrade crossing under tracks of Southern Pacific R.R. at Soledad, Monterey Co., to P. J. Tyler, P. O. Box 206, Oroville, and Lord & Bishop, Native Sons Bldg., Sacramento, $155,187, joint bid***constructing undergrade crossing under tracks of Southern Pacific R.R. at Salinas, Monterey Co., to F. O. Bohnett, Campbell, $249,108***undergrade crossing under tracks of Sacramento-Northern Railway at Broadway Terrace, Oakland, Alameda Co., to Lindgren & Swinerton, 225 Bush St., San Francisco, $103,386***overhead crossing under tracks of Western Pacific R.R. at Jackson St., Hayward, Alameda Co., to Peninsula Paving Co., 9 Main St., San Francisco, $87,161***widening overhead crossing over tracks of Southern Pacific R.R., San Francisco, San Francisco Co., to F. C. Amoroso & Sons, Keith and Wallace Aves., San Francisco, $28,940. Grand total $1,186,814. Bids Dec. 10, awarded Dec. 19, 20 and 24. Noted Nov. 29, C. D.—Dec. 5, E. N.-R.

California — State Hy. Comn., State Bldg., Los Angeles, rein.-con. girder overhead crossing, consisting of one 61 ft. and two 45 ft. 6 in. clear spans and grading, concrete paving 0.54 mi. roadway over tracks of Southern Pacific R.R., 2.2 mi. west of Indio, Riverside Co., to B. G. Carroll, 4396 Maryland Ave., San Diego, $105,830***steel, concrete overhead crossing, consisting of four 61 ft. 6 in., two 42 ft. and two 39 ft. spans, asphaltic concrete and concrete paving and grading approaches over tracks of Atchison, Topeka & Santa Fe R.R. at Wilmington, Los Angeles, to Sharp & Fellows Contg. Co., Central Bldg., Los Angeles, $202,942. Bids Nov. 29, awarded Dec. 16. Noted Dec. 9, C. D.—Nov. 21, E. N.-R.

Calif., Los Angeles—See "Waterworks."

Colorado—State Hy. Dpt., State Office Bldg., Denver, bridge and gravel approaches 0.587 mi. hy. between Strasburg and Anton, State Hy. 102, Adams and Arapahoe Counties, and railroad overpass with gravel surfaced approaches 0.568 mi. hy. between Kit Carson and Cheyenne Wells, on State Hy. 8, WPGH 278-J, Cheyenne Co., to E. H. Honnen, 208 West Las Animas St., Colorado Springs, $109,891 and $79,279 respectively. Bids Dec. 26, awarded Dec. 31.

†**Ga., West Point**—U. S. Eng., 1 rein.-con., structural steel span for widening bridge over Chattahoochee River, to Hardaway Contg. Co., Columbia, $27,675. Bids Dec. 11. Noted Dec. 19, C. D.

Illinois—State Dpt. P. Wks. & Bldgs., Div. Hys., Springfield viaduct over Illinois Central R.R. southeast of Freeport, Stephenson Co., to Clinton Eng. Co., Clinton, Ia., $23,435***structure for subway under Wabash R.R. at Tolono, Champaign Co., to R. McCalman, Inc., Danville, $34,699***viaduct over Cleveland, Cincinnati, Chicago & St. Louis R.R. west of Shelbyville, Shelby Co., to Zimmerly Bridge Co., Paris, $13,164***2 bridges and culvert northeast of Elizabethtown, Hardin Co., to Regenhardt Constr. Co., Cape Girardeau, Mo., $14,906*** 3 bridges and culvert on Route 70, east of Kings and DeKalb Co. Line, Ogle Co., to Sheppert Eng. Co., Belvidere, $50,371***6 bridges between Hancock and Nauvoo, Hancock Co., to A. P. Munsen, Marion, Ia. $77,935***bridge over Cedar Creek, north of Quincy, Adams Co., to W. Wells & Son, Quincy, $17,847***2 bridges between Route 2, north of Vandalia, and Montgomery Co. line, Fayette Co., to A. Culverson, Pana, $31,576***3 bridges, 4 culverts, between Alsey and Whitehall, Greene and Scott Counties, to P. McGlone, City Bank Bldg., Kansas City, Mo., $69,998***substructure for 2 bridges west of Havanna, and north of Route 98, Fulton Co., to Watt Constr. Co., Winchester, $31,869***viaduct over Mobile & Ohio R.R. at Jonesboro, Union Co., to Parham Constr. Co., East St. Louis, $21,368***bridge on relocation north of Sandusky, Alexander Co., to H. E. Cawood, Mount Vernon, $18,401. Grand total $405,569. Noted Dec. 13 and 30, C. D.

★ **Ill., Chicago**—Bd. Local Impvts., City Hall, constructing 276 ft. bridge over Calumet River at Torrence Ave., to Great Lakes Dredge & Dock Co., 104 South Michigan Blvd., $795,021. Bids Nov. 19. Noted Nov. 1, C. D.—Nov. 7, E. N.-R.

Indiana—State Hy. Comn., Indianapolis, rein.-con. bridge over Pennsylvania & C. & O. Rys., and over Converse and Marion Rds., Grant Co.,

Bridges, etc. (Continued)

to J. A. Crosvie, Bluffton, $59,980. Est. $83,-511. Bids Nov. 19.

Maryland—State Rds. Comn., Baltimore, constructing steel girder bridge with steel interlocking floor on present abutments over tracks of Pennsylvania R.R. at Guilford Ave., in Baltimore, to American Bridge Co., Mercantile Trust Bldg., Baltimore, $184,186. Noted Dec. 16, C. D. —Dec. 19, E. N.-R.

Maryland—State Roads Comn., Baltimore, constructing new bridge over Patapaco River at Edmondson Ave. Ext., Baltimore and Howard Counties, to Empire Constr. Co., 31 South Calvert St., Baltimore, $136,504. **P.W.A.** Noted Jan. 2, C. D.—Jan. 9, E. N.-R.

Minnesota—State Hy. Comn., St. Paul, constructing Bridge 5490, State Project 9-152-22-2, WPSS 507-C, truss span and approaches south of Campbell, Wilkin Co., to McCree & Co., 918 New York Bldg., St. Paul, and to Widell Co., Mankato, $22,552. Bids Dec. 20.

Minnesota—State Hy. Dpt., St. Paul, constructing 180 ft. bridge, 34 mi. west of Monticello, in Wright Co., to Nolan Bros., 18 North 2nd St., Mineapolis, $37,041. **P.W.A.** Bids Dec. 13. Noted Dec. 30, C. D.

Mississippi—See "Streets and Roads."

New Hampshire — State Hy. Dpt., Concord, 108 ft. steel plate girder bridge with rein.-con. abutments, over railroad, and 45 ft. rein.-con. "T" beam bridge over railroad, both in Hampton, Rockingham Co., to Engineering Service & Constr. Co., 161 Devonshire St., Boston, Mass., $72,850 and $31,983 respectively. Est. $80,000 and $30,000 respectively. Bids Dec. 19. Noted Jan. 2, C. D.

New Jersey—State Hy. Dpt., Trenton, constructing bridge to carry Route 34, Sect. 5, across tracks of Freehold and Jamesburg R.R., Monmouth Co., to Delta Constr. Co., Hopewell, $47,907. Bids Dec. 16, awarded Jan. 7. Noted Dec. 27, C. D.—Jan. 2, E. N.-R.

O., Cincinnati — City, general contract constructing McMillan St. bridge, to Kerpen Constr. Co., 1030 Summer St., $166,653. **P.W.A.**

Oklahoma—State Hy. Comn., Oklahoma City, 6 span 270 ft. I-beam overpass over Sante Fe and over Frisco Ry. at Clinton, Custer Co., to T. C. Ottinger, Hinton, $80,630. Est. $91,-560. Bids Dec. 30. Noted Dec. 24, C. D.

Oklahoma—State Hy. Dpt., Oklahoma City, overpasses in Marshall Co., to Merveldt & Stebbins, El Reno, $39,143 est. $43,533•••in Hughes Co., to Nius & Frost, Hydro, $30,279 est. $40,030•••in Cimarron Co., to R. R. Tway, Inc., 510 East 19th St., Oklahoma City, $45,-395 est. $46,908. Grand total $114,817. Bids Dec. 30. Noted Dec. 24, C. D.

Oregon—State Hy. Comn., Salem, constructing bridge over John Day River, Grant Co., to T. Lillabo, Reedsport, $62,818. Noted Dec. 6.

Pa., Pittsburgh — See "Sewerage and Waste Disposal."

Pennsylvania—See "Streets and Roads."

Pa., Jersey Shore—Boro, Lycoming Co. and New York Central R. R., constructing new highway bridge over tracks of railroad in western end of boro, replacing 1-way span, to Altoona Constr. Corp., Altoona, $31,711. Est. $43,000. Noted Mar. 28.

Tex., Houston—Southern Pacific Co., New Orleans, La., railway bridge, separate contracts awarded. About 250 tons structural steel, to Jones & Laughlin, 3rd Ave. and Ross St., Pittsburgh, Pa. Est. exceed $25,000.

Vermont—State Hy. Dpt., H. E. Sargent, ch. engr., Montpelier, 0.1 mi. underpass on Route 12, Berlin, to Troy Paving Co., 418 Stanley Bldg., Troy, N. Y., $19,804; 0.5 mi. underpass on Route 30, under Central Vermont R.R. tracks, Vernon, to M. J. Burrington, Jr., Bennington, $29,851. Bids Dec. 20, awarded Jan. 3. Noted Dec. 16, C. D.

Washington—Office of L. V. Murrow, dir. Hys., Olympia, constructing steel girder undercrossing N. P. Ry. Co., Olympia to Nisqually, Point Defiance Line U. S. Wks. Project WPGH 171-J Pierce Co., to Malcolm & Bell, 447 Sherlock Bldg., Portland, Ore., $97,308. Bids Dec. 20. Noted Dec. 17, C. D.—Dec. 19, E. N.-R.

Washington—Office of L. V. Murrow, dir. Hys., Olympia, constructing steel girder undercrossing Great Northern Ry. Company tracks State Rd. 7, 3 mi. west of Ephrata, U. S. Wks. Project WPH 219-B and WPGH 219-A Grant Co. and constructing steel girder overcrossing West Dravus St., Seattle, U. S. Wks. Project WPGM 227-A, King Co., to D. Nygren, 309 Lloyd Bldg., Seattle, $56,984 and $99,442 respectively. Bids Dec. 17. Noted Dec. 10, C. D.

Washington—Office of L. V. Murrow, dir. Hys., Olympia, constructing 280 ft. steel span with rein.-con. approach on west end and pile timber approach on east end State Rd. 8, Cook East, Little White Salmon River Bridge, Federal Aid Project, 112-G Skamania Co., to Puget Sound Bridge & Dredging Co., 2929 16th Ave. N.W., Seattle, $92,824. Bids Dec. 17. Noted Dec. 10, C. D.

Wis., Kenosha—Chicago & Northwestern Railway Co., C. T. Dike, ch. engr., 400 West Madison St., Chicago, Ill., constructing track elevation at 63rd and 65th Sts., to Foley Bros., Inc., New York Life Bldg., St. Paul, Minn., $335,739. Bids Dec. 19.

†*Federal Government.*

STREETS AND ROADS

BIDS ASKED

Arizona — Jan. 24, by State Hy. Comn., Phoenix, grading, draining, cutback oil cake surfacing 8.8 mi. Phoenix-Yuma Hy., WPGH 46-B and WPGH 46-C, A.F.E., 8073, incl. 46,-800 drainage, 1,100 cu.yd. structure, 12,000 cu.yd. roadway excav.; 2.1 mi. Ashfork-Kingman Hy. WPGH 118-A, A.F.E. 6638, 101,500 cu.yd. roadway excav.; 3,900 cu.yd. drainage excav. T. S. O'Connell, state hy. engr.

Kansas—Jan. 24, by State Hy. Comn. at office of County Clerk, Hill City, light type surfacing, earthwork, culverts, bridging 57.627 mi. hys. in Smith, Rawlins, Norton, Osborne, Graham, Decatur and Cheyenne Counties.

Kansas—Jan. 25, by State Hy. Comn. at office of County Clerk, McPherson, resurfacing, light type surfacing, earthwork, culverts, bridging, concrete paving 132.75 mi. hys. in Washington, Clay, Cloud, Dickinson, Ellsworth, Geary, Lincoln, Morris, and Saline Counties.

Louisiana — Jan. 22, by State Hy. Comn., Baton Rouge, H. B. Henderlite, state hy. engr.: A. P. Tugwell, chn., grading, surfacing 13.37 mi. Group 2 hys., Routes C-1427-C, 1428-117, 1025 and 1022, Project 11129, Arcadia Parish; grading, gravel surfacing 4 mi. Route 42-West Hy. on Route 98, Project 1075, Calcasieu Parish; grading, drainage structures, incl. 1,477 mi. shell surfacing, etc., on 9.925 mi. Hackberry-Bayou Choupique Hy., on Route 104, Project 1913-Apl. N.R.H. 186-B, Cameron and Calcasieu Parishes.

Louisiana — Jan. 29, by State Hy. Comn., Baton Rouge, H. B. Henderlite, state hy. engr. **(P. means Project)**, surfacing, etc., 17 mi. Hackberry-Intersection Route 292 Hy. Route 104, P. 188-A-3, Cameron Parish; 2.5 mi. Watson-Amite River Hy., Route 103, P. 1125, Livingston Parish; grading, surfacing 4.81 mi. Jonesville School Intersection Route 16 Hy., Route 593, P. 840-A, West Carroll Parish; 2.512 mi. Hodge-Intersection Route 166, Route C-1391, P. 1069, Jackson Parish; 7.263 mi. Couley-St. Maurice Hy., Route 480, P. 1084, Winn Parish; 8.607 mi. Eden Fellowship-Jena Hy., Routes C-1415, C-1416 and C-1417, P. 1107, La Salle Parish; 7 mi. Hurricane-Intersection Route 115 Hy., Route 565, P. 1122, Claiborne Parish; 9 mi. Serena-Boggy Bayou Hy., Route 116, P. 1121, Catahoula Parish; 3 mi. Longstreet-Belle Bowe Hy., Route C-1425, P. 1123, De Soto Parish; 5.5 mi. Stay-Intersection Route 1 Hy., Route C-1426, P. 1124, Grant Parish; 5 mi. McGinty-East Hy., Route C-1412, P. 1126, Morehouse Parish; 1.5 mi. Intersection Route 5-Intersection Route 40 Hy., Route 770, P. 1127, St. Landry Parish; concrete paving 3.2 mi. Donaldsonville-White Castle Hy., Route 168, P. 3301-B, Ascension Parish; 9.012 mi. Tangipahoa-Mississippi State Line Hy., Route 33, F.A. Project 6205-B, Tangipahoa Parish.

Louisiana — Feb. 5, by State Hy. Comn., Baton Rouge **(P. means Project)**, grading, gravel surfacing 5 mi. Mount Pleasant-Wardville Hy., Route C-1431, P. 1137, Morehouse Project, $25,000; 7.784 mi. Carenco-Pointe Brule Hy., Route 988, P. 1135, Lafayette Parish, $35,000; 7.27 mi. Quitman-Beech Spring School Hy., Routes 545 and 547, P. 1134, Jackson Parish, $35,000; 4.3 mi. Route 575, between Routes 23 and 576, P. 1132, Evangeline Parish, $23,000; 4.97 mi. Columbus Post Office and Negreet Hy., on Route 536, P. 1092, Sabine Parish, $25,000; 6 mi. Kelley-Intersection Route 111, Route C-1429, P. 1130, Caldwell and La Salle Parishes, $30,000; 2.3 mi. Salem Church and Intersection with Route 227 Hy., Route 441, P. 1136, Lincoln Parish, $15,-000; 3 mi. Central School-Haskin Hy., Route 640, P. 1133, Franklin Parish, $15,000; 3 mi. Gurley-Clinton Rd., Route C-1430, P. 1131, East Feliciana Parish, $15,000; 4 mi. Joe's Bayou-Intersection Route 45 Hy., Route 1285, P. 863-B, East Carroll Parish, $20,000; 13 mi. Central School-Baskin Hy., Route 640, P. 1133, Franklin Parish. H. B. Henderlite, state hy. engr.

Louisiana — Feb. 19, by State Hy. Comn., Baton Rouge, H. B. Henderlite, state hy. engr. **(P. means Project)**, grading, surfacing 2.998 mi. Intersection Route 21-Intersection Route 138 Hy., Route 501, P. 881-A, Vernon Parish; 3 mi. Intersection Route 200-Sterlington Hy., Route 1297, P. 892-A, Ouachita Parish; 3 mi. Dodson-Winn Jackson Parish Line Hy., Route 1200, P. 899-A, Winn Parish; 2.7 mi. Intersection Route 550-Burn's Settlement Hy., Route C-1370, P. 1041, Richland Parish; 2 mi. St. Mathews Church-South Hy., Route 247, P. 1048, Terrebone Parish; 4.8 mi. Maringouin-Valverda Hy., Route 982, P. 1117, Iberville and Pointe Coupee Parishes; 9 mi. Marthaville-Allen Hy., Route C-1435, P. 1146, Natchitoches Parish; 2 mi. Noble-West Hy., Route 1142, P. 1147, Sabine Parish; 6 mi. Pine Grove-Intersection Route 506 Hy., Route C-1436, P. 1148, St. Helena Parish; 5 mi. Boothville-Venice Hy., Route 396, P. 1149, Plaquemines Parish; 4 mi. Intersection Route 1092-Intersection Route 1-92 Hy., Route 905, P. 1150, St. Mary Parish; 5 mi. Intersection Route 262-Tynes Store Hy., Route C-1437, P. 1154, Washington Parish; bridge on 1 mi. Intersection Route 124-Little Bayou Sara Hy., Route 855, P. 1155, West Feliciana Parish.

Maryland—Jan. 21, by State Roads Comn., Baltimore, grading, drainage for 110 ft. dual

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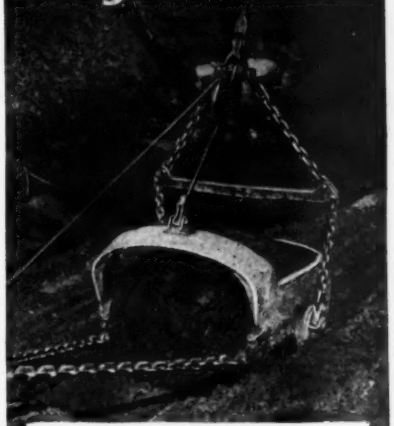

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Streets and Roads (Continued)

hy. 4.78 mi. along Annapolis Blvd. relocation from Marley Station to Robinson, Contr. AA-211-311, Anne Arundel Co.: 3.75 mi. Hagerstown-Meyersville Frederick Rd., Contr. W-188-625, Washington Co.: 4.4 mi. Hagerstown-Meyersville-Frederick Rd., Contr. F-272-525, Frederick Co.; 2.94 mi. Hagerstown-Meyersville-Frederick Rd., Contr. F-273-525, Frederick Co. P.W.A. project.

Massachusetts—Jan. 28, by Commonwealth of Massachusetts, Dpt. P. Wks., W. F. Callahan, comr., 100 Nashua St., Boston, 9,750 sq.yd. bituminous concrete sidewalks and incidental work along newly constructed hy., Projects NRM 251-B and NRH 251-A (1935), part Boston and Dedham. To exceed $23,000.

Mo., St. Louis — Jan. 28, by Bd. P. Service, City Hall, asphaltic concrete paving 4,335 sq.yd. Haven St., $37,950; refined asphalt paving 515 sq.yd. 13th St., $5,957; 1,910 sq.yd. Pine St., $26,170. P.W.A. project. L. A. Pettus, city engr.

N. Y., Batavia—See "Contracts Awarded."

Ohio—Jan. 28, by J. J. Jaster, Jr., Ohio Hy. Dir., Columbus, grading, drainage structures roadside improvement, widening and hot mixed, hot laid asphaltic concrete paving, 2.526 mi. Sect. C, Maumee Northern Road, State Hy. 696, U. S. Route 20 N, Adams Twp., Lucas Co., $179,244***grading, drainage structures (except bridges) placing bank run gravel surface 8.307 mi. Upper Twin Creek Rd. County Hy. 88, 96, Brush Creek and Nile Twps., Scioto Co., $36,648***Proposal 1, grading, drainage structures, concrete paving and roadside improvements, 1.995 mi. and Proposal 2, capping wings and placing new concrete surface on existing concrete beam bridge, 0.005 mi. Sect. D Eaton-Richmond Rd. State Hy. 249, State Route 11, U. S. 35, Washington Twp., Preble Co., $87,653 and $320 respectively***grading, drainage structures, roadside improvements, cold mixed cold laid tar paving, 2.94 mi. Sect. A and part of Sect. O, Toledo Wauseon Rd., State Hy. 20, State Route 2, U. S. 20, Clinton and York Twps., Fulton Co., $132,064***grading, drainage structures, traffic bound material paving 0.397 mi. Quincy Sect. and part Sect. D Dayton Lakeview Rd., State Hy. 27, Route 69, Miami Twp., Logan Co.

CONTRACTS AWARDED

Arizona—State Hy. Dpt., Phoenix, grading, draining 5.5 mi. Prescott Jerome Hy., to Pearson & Dickerson Constr. Co., Inc., P. O. Box 471, Prescott, $141,960. Bids Dec. 6. Noted Dec. 19, C. D.

Arizona—State Hy. Comn., Phoenix, grading, draining 3.2 mi. Globe-Springerville Rd., to H. J. Hagen, Globe, $173,346. Bids Dec. 10. Noted Dec. 19, C. D.

Arkansas—State Hy. Dpt., Little Rock, grading, drainage, bituminous on gravel surfacing 5.6 mi. Batesville South Rd., Independence Co., and 12 mi. West Murfreesboro-Nashville Rd., Pike, Howard and Hempstead Counties, to A. C. Kennedy, Poyen, $46,729 and $65,700 respectively, est. $60,000 and $80,000 respectively***earth embankment approach and concrete pavement over C. R. I. and P. R. R. and M. O. P. overpass, West 12th St., Little Rock, Pulaski Co., to F. Luttjohann, 417 East 13th St., Topeka, Kan., $35,122 est. $60,000. Grand total $146,551. Bids Dec. 27.

California — State Hy. Comn., Sacramento, grading, applying road-mix surface treatment and seal coat 5.5 mi. hy. between Ede's Ranch and Beckwith, Plumas Co., to A. Teichert & Son, Inc., P. O. Box 1113, Sacramento, $67,255. Bids Dec. 3, awarded Dec. 16. Noted Dec. 18, C. D.—Nov. 28, E. N.-R.

California — State Hy. Comn., Sacramento, grading, asphaltic concrete paving 0.7 mi. hy., removing existing railroad tracks and installing new tracks on adjacent right-of-way, East 12th St. between 20th and 29th Aves., Alameda Co., to Healey-Moore Co., 344 High St., Oakland, $41,240***grading, applying penetration oil treatment 11.8 mi. hy. between point 24 mi. west of Cedarville and Nevada State Line, Modoc Co., to C. F. Frederickson & Sons, Lower Lake, $79,236***grading, widening plant mix surfacing 16.4 mi. hy. between Walnut Grove and Freeport, Sacramento Co., to A. Teichert & Son, P. O. Box 1113, Sacramento, $131,816***grading, rein.-con. bridge 1.8 mi. hy. between south fork Mokelumne River and Herbart's Ranch, Claveras Co., to Biasotti-Willard & Biasotti, 40 West Clay St., Stockton and Rocca & Co., Box 444, San Rafael, joint bid $146,940***grading, bituminous macadam on crusher run surfacing 1.8 mi. hy. between Stony Point Rd. and Cotati, Sonoma Co., to N. M. Ball Sons Co., P. O. Box 404, Berkeley, $60,856***grading, crusher base and sealcoat surfacing 1.5 mi. hy. between Lincoln and Newcastle Placer Co., to Hemstreet & Bell, 501 11th St., Marysville, $28,132. Grand total $488,220. Bids Dec. 11, awarded Dec. 19. Noted Dec. 30, C. D.

Colorado—State Hy. Dpt., Denver, gravel surfacing 18.402 mi. hy. between Ft. Morgan and Roggen on Road 81, F.A.P. 285-H, Weld and Morgan Counties, to Blanchard Bros., 1641 South Logan St., Denver, $313,425. Bids Dec. 26, awarded Dec. 31.

D. C., Wash.—District Comrs., District Bldg., improving Kenilworth Ave. N. E. from Dixon Ave. to district line, to Highway Eng. & Constr. Co., 7th and T St., N. E., $89,862.

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★ **Georgia**—State Hy. Dpt., Atlanta, paving 2.816 mi. Blairsville Blue Ridge Rd., Union Co. and 0.728 mi. Macon-Perry Rd., Bibb Co., to M. J. Carroll, Inc., Ocala, Fla. $38,4[illegible] and $45,125 respectively***3.933 mi. Lyons-Reidsville Rd., Toombs Co., to Coffee Constr. Co., Eastman, $39,429***5.397 mi. Monticello-Thomasville, Ga. Rd., Thomas Co., to Duval Eng. & Constr. Co., Dyal Upchurch Bldg., Jacksonville, Fla., $89,734***3.125 mi. Carrollton-Cedartown Rd., Polk Co., to Claussen-Lawrence Constr. Co., 1394 Gwinnett St., Augusta, $53,284***4.15 mi. Cairo-Pelham Rd., Mitchell Co., and 3.328 mi. Cairo-Pelham Rd., Grady Co., to Wm. F. Bowe, Jr., 540 Reynolds St., Augusta, $33,837 and $27,038 respectively***0.770 mi. Cartersville-Dalton Rd., Gordon Co., to Barlow Gordy Constr. Co., Hill Bldg., and H. McMath Exchange Bldg., Columbus, $53,154***8.581 mi. Atlanta-Buford Rd., De Kalb and Fulton Counties, to Hardaway Constr. Co., 15 11th St., Columbus $171,666***6.799 mi. Sylvania-Waynesboro Rd., Burke Co., to Interstate Constr. Co., Independent Life Bldg., Nashville, Tenn., $42,473***paving and 1 bridge 1.296 mi. Georgetown-Cuthbert Rd., Quitman Co., to R. F. Taylor, Cuthbert, $22,208. Grand total $616,361. Bids Dec. 20. Noted Jan. 2, C. D.

★ **Illinois**—Dpt. P. Wks. & Buildings, Div. Hys., Springfield, paving 1.45 mi. Elston Ave. from Lawrence Ave. to Irving Park Blvd. and 1.08 mi. Elston Ave. from Roscoe St. to Irving Park Blvd., both Chicago, Cook Co., to Aldrich Constr. Co., 111 West Washington St., Chicago, $181,481 and $126,044 respectively***6.05 mi. Woodstock south, McHenry Co., to E. M. Melahn Constr. Co., Algonquin, $166,193***5.95 mi. road from Huntley north, McHenry Co., to C. E. Giertz & Son, Elgin, $167,312***grading 1.48 mi. road from Route 64 to Villa Park, DuPage Co., to T. McQueen, Forest Park, $189,984***0.85 mi. approaches to Cleveland, Cincinnati, Chicago & St. Louis R. R. viaduct, west of Shelbyville, Shelby Co., and 4.26 mi. road from Concord to Arenzville, Morgan and Cass Counties, to Dungey & Cochran Constr. Co., Marion, $33,492 and $43,791 respectively***5.53 mi. road from point north-west of Sycamore west, DeKalb Co., to Fruser Bros., 2148 Ainslie St., Chicago, $123,256***1.91 mi. Decatur South Belt Line Road, 2 to Route 121, Macon Co., to French Constr. Co., Fairfield, $61,765***3.28 mi. Elizabethtown northeast, Hardin Co., to Ulen & Gandy, Ullin, $19,907***0.49 mi. approaches to Wabash R. R. subway at Tolono, Champaign Co., to General Paving Co., Champaign, $46,786***0.94 mi. Lee St. from Rand Rd. to Soo line R. R., Cook Co., to Suburban Paving & Impvt. Co., 140 North Dearborn St., Chicago, $86,928***0.95 mi. road from Chicago Ave. south to 55th St., Clarendon Hills and Hinsdale, Du Page Co., to Advance Constr. Co., Hinsdale, $73,882***0.44 mi. North Main St. from Big Four to Elm Sts., Harrisburg, Saline Co., to Feigel Constr. Corp., Evansville, Ind., $34,539***0.36 mi. 3rd St. to Fort Edward Monument in Warsaw, Hancock Co., and grading 2.92 mi. from Eddyville toward Elkhorn, Pope Co., to Triangle Constr. Co., Kankakee, $5,970 and $39,840 respectively***bituminous rock surfacing 0.76 mi. Route 90 to Monica Rd., Peoria Co., to Rock-Road Constr. Co., 5915 North Rogers Ave., Chicago, $6,740***7.98 mi. road from Lerna to Campbell Rd., Coles Co., to West Counties Constr. Co., Kenilworth, $28,774***8.71 mi. Coffeen to Fayette Co. line Montgomery Co., to Powers Constr. Co., Bloomington, $68,209***8.22 mi. road from Kellerville to Route 108, Adams Co., to Illinois Valley Constr. Co., Ottawa, $102,867***1.12 mi. road north of Sandusky, Alexander Co., to Barnett & McCoy Co., Carbondale, $5,363***traffic bound macadam paving 11.56 mi. at Assumption, Christian Co., to H. Rue, Shelbyville, $82,431***1.39 mi. from Pere Marquette Park north toward Route 38, Jersey Co., to Walsh Oil Co., Inc., Joliet, $27,304. Grand total $1,772,044. Bids Nov. 15, 21 and 27, Dec. 6, 13 and 20.

Indiana—State Hy. Comn., Indianapolis, rock asphalt paving 0.446 mi. road in Grant Co., to R. L. Harris, State Road Blvd., Fort Wayne, $22,294. Est. $24,108. Bids Dec. 3.

Indiana—State Hy. Comn., Indianapolis, reincon. paving 1.024 mi. road in Sullivan Co., to W. Vogel, 1103 Merchants Bank Bldg., Indianapolis, $68,796 est. $75,234***bituminous concrete paving road in Adams Co., to Middlewest Roads Co., 421 Illinois Bldg., Indianapolis, $119,943 est. $117,712***0.869 mi. road in Wabash Co., to Paving Products Co., Inc., Peru, $42,743 est. $51,516***0.695 mi. in Stone Co., to Mesbberger Bros. Stone Co., Linn Grove, $14,476 est. $16,522. Grand total $245,958. Bids Nov. 19 and Dec. 2. Noted Dec. 10, C. D.—Nov. 28, E. N.-R.

Louisiana—State Hy. Comn., Baton Rouge, grading, gravel surfacing 9 mi. Oakdale-Bond Hy., Project 1052, Allen Parish, to Nelson Bros., Baton Rouge, $44,490. Bids Dec. 11. Noted Dec. 6, C. D.

★ **Louisiana**—State Hy. Comn., Baton Rouge, to Nelson Bros., Baton Rouge, concrete paving 6.222 mi. Monroe-Alto Hy., Project 5104-A, Richland Parish, $161,701; 8 mi. Hineston-Lemieuse Hy., Project 1063, Rapides Parish, $29,419; 7.068 mi. Sikes-Hoods Mill Hy., Project 812-F, Winn and Jackson Parishes, $70,711; 7.5 mi. Routes 344 and C-1387, Project 1065, Tensas Parish, $32,501 grading, iron ore surfacing 7 mi. Cherry Ridge-Arkansas State Line Hy., Project 856-C, Union Parish, $43,310***to F. J. D'Autremont, Jacksonville, Tex., grading, gravel surfacing 7 mi.

†*Federal Government.*

Streets and Roads (Continued)

Rosefield-Antioch School Hy., Project 1061, La Salle Parish, $55,736; 3.997 mi. Turkey Creek-Baskin Hy., Project 827-B, Franklin Parish, $34,123***to Wimberly Constr. Co., Arcadia, 8.803 mi. Plain Dealing-Rock Mount Hy., Project 1009, Bossier Parish, $46,666; grading, iron ore surfacing 6.67 mi. Price Peach-Orchard Holder Hy., Route 481, Project 867-A, Bienville Parish, $27,453***to R. B. Tyler Co., 1446 Levering St., Louisville, Ky., grading, gravel surfacing 5.904 mi. Morris Retreat-Folsom Hy., Project 956-A-2, Tangipahoa and St. Tammany Parishes, $18,027; 10.4 mi. Killian Chapel-Int. Route 35 Hy., Project 768-C-1, St. Helena Parish, $26,061***to Robinson & Young, Baton Rouge, 10.2 mi. Intersection Route 34-Intersection Route 302, Project 889-A and B, St. Tammany and Washington Parishes, $57,964***to Barber Bros. Contg. Co., Baton Rouge, 8 mi. Port Vincent-Int. Route 335 Hy., Project 1062, Livingston Parish, $40,455 ***to Le Blanc Bros., St. Gabriel, 5 mi. Lafayette-North Hy., Project 1060, Lafayette Parish, $22,827***to W. T. Burton, Sulphur, shell surfacing 8 mi. Creole-East Hy., Route 871, Project 1018, Cameron Parish, $28,073; grading, shell surfacing 11.628 mi. Lake Charles-Gulf Beach Hy., Project 1056, Calcasieu and Cameron Parishes, $70,730***to J. F. Campbell Co., New Orleans, 0.7 mi. street in Mc-Donoghville, Project 1059, Jefferson Parish, $4,314***to I. M. Goldberg, Abbeville, 5.894 mi. Indian Bayou-Ebenezer Lapine Bridge, Project 1058, Lafayette and Vermillion Parishes, $53,365***to National Constr. Co., 501 North Olympia St., New Orleans, 1.2 mi. Int. Airline-Int. Route 1 Hy., Project 1064, St. John the Baptist Parish, $5,728. Grand total $829,164. Bids Dec. 18. Noted Dec. 4, 9 and 17, C. D.—Dec. 12, **E. N.-R.**

★ **Louisiana**—State Hy. Comn., Baton Rouge, to I. M. Goldberg, Abbeville, grading, reef shell surfacing 17.9 mi. Group 4 hys., Project 1085, Vermillion Parish, $119,382***to Wimberly Constr. Co., Arcadia, grading, gravel surfacing 5 mi. Intersection Route 66-Millerton Hy., Project 1079, Webster Parish, $17,941; grading, iron ore surfacing 4 mi. Webster Parish Line-Ruple Hy., Project 1077, Claiborne Parish, $10,417***to R. D. Tyler Co., 1446 Levering St., Louisville, Ky., grading, iron ore surfacing 4.3 mi. hys., Project 1080, West Feliciana Parish, $16,809***to Doullut & Ewin, Q. & C. Bldg., New Orleans, grading, graveling 6.052 mi. Oak Bayou and Ardvin School Rds., Jefferson Davis Parish, $38,585***to Forcum-James Co., Dyersburg, Tenn., grading, gravel surfacing 4.905 mi. Elm Grove-Lake Bisteneau Hy. Project 890-B, Bossier Parish, $38,544 ***to C. R. Laborde, Bordelonville, 3.355 mi. Dora-Intersection Route 30 Hy., Project 883-A, Avoyelles Parish, $17,627***to J. L. Ham & Co., Minden, 11.464 mi. Olla-Sikes Hy., Project 812-A-1, La Salle, Caldwell and Winn Parishes, $38,966***to Barber Bros. Contg. Co., Baton Rouge, 4.087 mi. Pine Prairie-Beaver Hy., Project 727-B, Evangeline Parish, $30,380***to Martin & Nicols, Alexandria, 3.257 mi. Gilbert-Ft. Necessity, Project 691-A-1, Franklin Parish, $9,176***to Nelson Bros., Baton Rouge, 17.291 mi. hys., Project 1073, Acadia Parish, $81,466***to Flemmiken Constr. Co., Shreveport, 6.7 mi. Vivian-Hosston Hy., Project 1070, Caddo Parish, $33,328***to Caldwell Constr. Co., Grayson, 7 mi. Grayson-Intersection Route 111, Project 1076, Caldwell and La Salle Parishes, $72,353***to Robinson & Young, Baton Rouge, 4.058 mi. Pride-Intersection Route 36, Project 1068, East Feliciana Parish, $21,097; 6.25 mi. Cherry Grove-South Hy., Project 1074, Allen Parish, $37,923; grading, shell surfacing 3.057 mi. Weber Plantation-Chenvert Hy., Project 1082, Assumption and Lafourche Parishes, $22,484***to W. R. Aldrich, Baton Rouge, 11.595 mi. hys. on Routes C-1395, C-1396, C-1307 and 540, Project 1078, Lafayette Parish, $49,453. Grand total $655,931. Bids Dec. 31. State Hy. Dpt. rejected bids Dec. 31, improving 4.374 mi. hy. De Soto Parish, and did not receive bids for improving 4 mi. hy., Calcasieu Parish. Noted Dec. 17, C. D.—Dec. 19, E. N.-R.

Maryland—State Roads Comn., Federal Reserve Bank Bldg., Baltimore, grading, drainage 2.05 mi. along new road from Patapsco to Jonestown, to Empire Contg. Co., 31 South Calvert St., Baltimore, $195,850; grading, drainage 1.8 mi. new road from Jonestown to Route 40, to Einhardt & May, 5723 Harford Rd., Baltimore, $77,714. **P.W.A.**

Maryland — State Rds. Comn., Baltimore, grading, drainage 1.56 mi. along new road along Edmondson Ave., extending from rolling road to Patapsco River, to E. J. Langenfelder & Son, Rosedale, $128,355. **P.W.A.** Noted Jan. 2. **C. D.—Jan. 9, E. N.-R.**

Maryland — State Roads Comn., Baltimore concrete paving 1.43 mi. Pocomoke City cut-off, Wicomico Co., to Hannaman Burroughs Co., Salisbury, $56,172; grading and draining 2.96 mi. dual highway along Annapolis Rd. Anne Arundel Co., to C. J. Langenfeld & Son, Rosedale, $73,583. **P.W.A.** Noted Dec. 16 C. D.—Dec. 19, **E. N.-R.**

★ **Maryland** — State Roads Comn., Baltimore, grading, drainage 3.5 mi. hy., Contr. F-271-525, Frederick Co., to H. J. Campbell & Sons, Towson, $332,182***concrete paving 3.04 mi., Contr. W-187-625, Washington Co., and 2.68 mi., Contr. W-189-625, F-270-1-525, Washington and Frederick Counties, to Roberts Paving Co., Salisbury, $149,766 and $123,523 respectively***concrete paving 0.11 mi., Contr. D-117-1-111, Dorchester Co., to Phillips Bros., Salisbury, $4,955. Grand total $610,426. Bids Dec. 23. State Roads Comn., Baltimore, rejected bids for grading, drainage, concrete paving 3.9 mi. Funkstown-Meyersville Rd., Washington Co., and Meyersville-Frederick Rd., Frederick Co. Noted Dec. 17, C. D.—Dec. 29, **E. N.-R.**

Md., Baltimore—**Bd. Awards**, concrete paving various streets, Contr. 661, to Mahoney Bros., 1111 Rutland Ave., $8,061; sheet asphalt paving streets, Contr. 662, to Baltimore Asphalt Block & Tile Co., 1320 North Monroe St., $45,-025. Bids Jan. 2. Noted Jan. 9, C. D.

★ **Minnesota**—**State Hy. Dpt., St. Paul**, concrete paving 3.9 mi. State Project 71-4-50, Div. A, F.A.P. 430, between 4 mi. south of Jackson and Jackson, and 5.3 mi. S.P. 55-116-21 and S.P. 52-116-22, W.P.M.H. 538 A and B, to Western Asphalt Paving Corp., 2110 East 4th St., Sioux City, Ia., $91,711 and $97,741 respectively***1.9 mi. S.P. 71-4-44-3A and B, N.R.H. 488C, and N.R.M. 448B and D, to DeRuyter Bros., Willmar, $206,335***5.4 mi. State Project 3-183-21-3A, W.P.S.S. 501-C, between point 9 mi. east of Hewitt and Staples, incl. 136,554 cu.yd. excav., to R. B. Fraser Constr. Co., Northfield, $36,338***0.5 mi. S.P. 10-3-62-1A, W.P.G.H. 114-A, between Big Lake and Elk River, 119,370 cu.yd. excav., to Megarry Bros., Bain, $19,162***1.7 mi. S.P. 53-11-39-5A and B, W.P.H. 379-G, and W.P.G.H. 379-G, between 2.5 mi. south of Cassonax and Orr, 101,303 cu.yd. excav., to E. W. Wylie, Inc., 2239 Ford St., St. Paul, $66,949***8.3 mi. road between Orleans-Lancaster S.P. 59-174-25-7A and B, W.P.G.S. 557-C, and W.P.G.M. 557-D, to S. J. Anderson, Warren, $37,863. Grand total $556,099. Bids Dec. 13. Noted Dec. 5, C. D.

★ **Mississippi**—E. D. Kenna dir. State Hy. Comn. Jackson, to Hodgkin-Adams Constr. Co., Winchester, Ky., grading, drainage structures, bituminous surfacing 1.081 mi. Brookhaven-Wesson Hy., Copiah Co., $40,137, est. $50,000; 0.451 mi. Brookhaven-Wesson Hy., Lincoln and Copiah Counties, $30,395 est. $45,-000***to F. S. Neely Amory, grading, drainage structures, bridges, temporary gravel surfacing 2.306 mi. Holly Springs-Memphis Hy., Marshall Co., $48,175 est. $40,000; grading, drainage structures, bridging 2.545 mi. Shuqulak-Macon Hy., W.P.G.H. 107-H, $121,182 est. $165,000; 1.666 mi. Shuqulak-Macon Hy., $42,430 est. $55 000, both Noxubee Co.***to Clark Bros. Constr. Co., Jackson, brick paving 1.406 mi. Clay and Washington Sts., Vicksburg, Warren Co., $43,994 est. $36,000***to Chas. Weaver, Jackson, grading, drainage structures, bridging, temporary gravel surfacing 4.459 mi. Tupelo-Corinth Hy., Lee and Prentice Counties $102,903 est. $130.000***to M. Harvey & W. I. Sharpe, Memphis and Batesville, grading, drainage structures, bridging, gravel surface course paving 8.719 mi. Glendora-Webb Hy., Tallahatchie Co., $149,538 est. $205,000***to E. A. McCaa, Port Gibson, 0.264 mi. Vaiden-West Hy. Carroll Co., $14,400 est. $15,000*** to Pigford Bros., Meridian and Shuptrine Constr. Co., Memphis, Tenn., 0.567 mi. Egremont-Rolling Fork Hy., Sharkey Co., $79,856 est. $62,000 ***to Cartwright Nurseries, 2929 Poplar Ave., Memphis, Tenn., roadside improvement and beautification 0.538 mi. Shannon-Tupelo-Booneville Hy., Lee Co., $1,127 est. $1,800***to W. G. Cook, Forest, semi-gravel surfacing 9.308 mi. Gillsburg-Magnolia Hy., Amite Co., $9,539 est. $12,000***to S. B. Boyd, Columbia, 20.819 mi. Bay Springs-Rose Hill Hy., Jasper Co., $27,-602***to Forcum-James Constr. Co., Dyersburg Tenn., grading, drainage structures, bridging 1.306 mi. Houston-Aberdeen Hy., Chickasaw Co., $64,787 est. $70,000; grading, drainage structures, bridging, temporary gravel surfacing 0.995 mi. Egremont-Rolling Fork Hy., Sharkey Co., $27,917 est. $26 000. Grand total $803,-982. Bids Dec. 3. **P.W.A.** Noted Dec. 11, C. D. —Nov. 26, E. N.-R.

Mississippi — E. D. Kenna, dir. State Hy. Comn., Jackson, grading, drainage structures, bridges and gravel surface course on 1.389 mi. Leland-Indianola Hy., Project WPH-213-D, Washington Co., to Vincennes Steel Corp., Vincennes, Ind., $32,461 est. $41,000***grading, drainage structures and bridges on 7.644 mi. Summitt-Norfield Hy., Project WPMH-86,109 and 217-B, Lincoln and Pike Counties, to Gerald Smith Constr. Co., Memphis, Tenn., $135,186 est. $108,000***on 9.42 mi. Meridian-Collinsville Hy., Project WPGH 101, 106 and WPGM 106 and 0.31 mi. Meridian-Nellieburg Hy., Project WPMH-192-C, Lauderdale Co., to Chas. Weaver, Jackson, H. E. Pigford, Meridian, and W. R. Strickland, Newton, $167,381 est. $210,000***3.269 mi. Batesville-Oxford Hy., Project WPH-208-C, Lafayette Co., to Froeming Bros., Inc., Green Bay and Gruber Aves., Milwaukee, $55,892 est. $63,000***grading, drainage structures, bridges and gravel surface course on 1.34 mi. Magee-Mize-Taylorsville Hy., Project WPSO-243-C, Smith Co., to Ball Constr. Co., Fayette, $55,024 est. $62,000***grading, drainage structures and gravel surface course on 2.482 mi. Holly-Springs-Senatobia Hy., Project WPSO-275-B, Tate Co., to Chas. Weaver, Jackson, $36,455 est. $36,000. Grand total $482,399. **P.W.A.** Bids Dec. 17. Rejected bids Dec. 17, roads and bridges in Pike and Warren Counties. Noted Dec. 11, C. D.

Mississippi — E. D. Kenna, dir. State Hy. Comn., Jackson, constructing 2 sections each, 2.9 mi. Slidell-Picayune Hy. on U. S. 11, Work Orders 707 and 706, 8.2 mi. Slidell-Bay St. Louis Hy. U. S. 90, Work Order 707, Hancock Co., to Smith Eng. & Constr. Co., Pensacola, Fla., $24,881. Noted Dec. 10, C. D.—Dec. 12, E. N.-R.

*Federal Government.

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AKRON, OHIO

Streets and Roads (Continued)

Missouri—State Hy. Dpt., Jefferson City, to E. B. Cooper, Hannibal, graveling 1.009 mi. road in Audrain Co., $559***to C. W. Rose, Brookfield, 3.404 mi. Chariton Co., $8,625*** to J. L. Pohl, Nevada, crushed stone or gravel surfacing 3.579 mi. Route N-Sumner Rd. 491A, $7,286; 1.292 mi. 491B, same road, $5,563; 3.037 mi. Linn Co.-Route E Rd., $6,536; 1.268 mi. Route A-Rothville Rd., $2,834, all foregoing Chariton Co.; 2.84 mi. Laclede-Chariton Rd., WPSS 489A, $6,136; 2.261 mi. WPSS 479B, same road, $4,847; 0.606 mi. Route N-Koker St., $1,361, all foregoing Linn Co. Grand total $43,747. Bids Dec. 20. Noted Dec. 13, C. D.

Mo., Clayton—City, A. H. Kerth, clk., widening streets and grading, paving alleys in De Mun Park and concrete paving Bemiston Ave., to Webb-Boone Paving Co., 5103 Fyler Ave., St. Louis. Est. $32,750. **P.W.A.** Bids Dec. 20. Noted Dec. 16 C. D

Mo., Farmington—City, asphalt on macadam paving various roads, to Trinidad Asphalt Mfg. Co., 600 South Theresa Ave., St. Louis, $30,000. **P.W.A.** Bids Dec. 6. Noted Dec. 3, C. D.

Mo., Fayette — Fayette Special Road Dist., C. H. Tindall chn., grading, improving system of farm to market roads in district, to R. M. McDowell, Inc., Midland Bldg., Kansas City, $93,455. Est. $100,000. Bids Dec. 11.

Mo., Gilliam — Gilliam Special Road Dist., Saline Co., constructing system of rural highways in district, to R. N. McDowell, Inc., Midland Bldg., Kansas City $135,443. Est. $152,177. **P.W.A.** Bids Oct. 8. Noted Sept. 30, C. D. —Oct. 3, E. N.-R.

Mo., Marshall—Comrs. Fairville Special Road Dist., Saline Co., Wood Hunter Bank Bldg., constructing system of rural roads, to R. Newton McDowell, Inc., Midland Bldg., Kansas City, $68,824. Est. $74,545. **P.W.A.** Bids Oct. 31. Noted Oct. 16 C. D.

Mo., Shackleford—Comrs. Shackleford-Mount Leonard Special Road Dist., Saline Co., Wood Hunter Bank Bldg., Marshall, constructing system of rural roads, to R. Newton McDowell, Inc., Midland Bldg., Kansas City, $54,826. Est. $63,636. **P.W.A.** Bids Oct. 17.

N. Y., Batavia—Bd. Supervs. Genesee Co, L. E. Phelps, co. supt., bituminous material surfacing 5.15 mi. highway in West Bergen Rd. $81,607***resurfacing 3 mi. Bank Rd. between Byron and Elba Sts. $23,000***constructing and maintaining various highways $70,000, by day labor and county forces. Grand total $174,607. Est. $175,000.

O, Akron — City, widening, macadam resurfacing 2 mi. Portage Lakes Dr., to McCourt Constr. Co., 365 South Main St., $85,720 est. $100,000; widening, brick repaving South High St. from Hackett St. to point 100 ft. south of Thornton St., to C. W. & P. Constr. Co. and Johnson & Johnson, 654 East Buchtel Ave. $53,102 est. $55,000. **P.W.A.**

Oklahoma—State Hy. Comn., Oklahoma City, grading, drainage, graveling 1.69 mi. Payne Co., to R. S. Smith Co., 2508 West 11th St., Oklahoma City, $14,746 est. $15,815; 1.99 mi. road in Harmaon Co., to Lee Pool & Sons, Fairview, $11,999 est. $12,139. Noted Dec. 24, C. D.

Oklahoma—State Hy. Comn., Oklahoma City, grading, drainage 4.87 mi. McIntosh Co., to T. C. Ottinger, Hinton, $23,717 est. $32,697 ***4.51 mi. Washita Co., to Merveldt & Stebbins, El Reno, $20,527 est. $20,530***7.95 mi. roads in Tulsa Co., to Pharah & Co., Henryetta, $70,113 est. $72,281. Grand total $114,357. Bids Dec. 30. Noted Jan. 8, C. D.

Oregon—State Hy. Comn., Salem, grading, surfacing 2 mi. Grays Creek Sect., William Hy., Josephine Co., 20 ft., to C. E. Hall, Eugene, $38,363. Bids Nov. 30. Noted Nov. 26, C. D.

Pennsylvania — P. M. Tebbs, for W. Van Dyke, secy. Hys., Harrisburg, dual type paving, 3 rein.-con. structures, etc., Hampden and Silver Springs Twps., Cumberland Co., to H. W. Shaull and Sons, Mechanicsburg, $271,913*** bituminous on native stone surfacing 2.17 mi., 1 rein.-con. structure, Bedford Co., to E. H. & L. A. Brua, Jr., Hollidaysburg $60,150***0.91 mi. bituminous on native stone surfacing, 1 rein.-con. structure, Clearfield Co., to New Castle Duntile Co., 1409 Moravia St., New Castle, $14,368***0.02 mi. cement rubble masonry retaining wall, Columbia Co., to Donaghmore Coal & Stone Co., 1218 Chestnut St., Lebanon, $3,743***grading and drainage 0.12 mi. Lehigh Co., to B. G. Coon Constr. Co., 278 Union St., Luzerne, $9,479***0.11 mi. rein.-con. I-beam overpass bridge, rein.-con. paving, Lycoming Co., to Altoona Constr. Co., 1425½ 12th Ave., Altoona, $31,707. Grand total $391,360. Bids Dec. 6. Noted Dec. 13, C. D.—Dec. 19, E. N.-R.

Pennsylvania — P. M. Tebbs, for W. Van Dyke, secy. Hys., Harrisburg, grading, drainage 28 ft. wide, 893 ft. rein.-con. bridge, Pine Twp., Columbia Co., and bituminous on native stone surfacing 0.18 mi. Valley Twp., Montour Co., to T. B. Evans, 344 Fairy St., Danville, $6,778 and $3,559 respectively***0.44 mi. bituminous on crushed stone surfacing and rein.-con. bridge, Montgomery Co., to J. F. Keelor, Green Lane, $29,923***0.9 mi. rein.-con. paving, rein.-con. arch, Bedford Co., to S. T. Brotemarkle Constr. Co., 3116 Brownsville Rd., Pittsburgh, $75,754***1.2 mi. bituminous on native stone surfacing, rein.-con. bridge, Clarion Co., to H. W. Gher, Waynesboro, $24,3[illegible]*** 4.04 mi. guard fence within distance of 0.77 mi. Greene Co. and 2.06 mi. guard fence within distance of 16.11 mi. Somerset Co., to J. Evans Constr. Co., Standard Life Bldg., Pittsburgh, $11,217 and $6,521 respectively, grand total $158,143. Bids Dec. 20. Noted Jan. 2, C. D.—Jan. 9, E. N.-R.

Pa., Monongahela City—Allegheny Co., Pittsburgh, concrete paving Monongahela City and Elizabeth Rd. via Lock 3, and Lock 3 and Elkhorn Rd., to J. W. Butler, 700 Walnut St., McKeesport, $23,446.

Pa., Pittsburgh—See "Unclassified."

Pa., Pittsburgh—Allegheny Co., concrete paving Wilmerding-East Pittsburgh Rd., to B. Consales Constr. Co., 2339 5th Ave., McKeesport, $194,897.

S. C., Chester — City, paving streets, storm sewers, to F. N. Thompson, 409 Queens Rd., Charlotte, N. C., $92,843. H. Beebe Co., Spartanburg, engr.

S. C., Pickens—Pickens Co., bituminous surfacing roads, to R. B. Tyler & Co., 1446 Livering St., Louisville, Ky. Est. $220,000. P.W.A. W. E. Rowe, Columbia, engr.

S. D., Mobridge—City, concrete paving 12,250 sq.yd. and bituminous surfacing 23,000 sq.yd. various streets, to Northwestern Eng. Co. and Lewis Constr. Co., Rapid City, $65,804. Est. $50,000. **P.W.A.** Bids Dec. 20. Noted Oct. 17, C. D.—Oct. 24, E. N.-R.

Texas—G. Gilchrist, state hy. engr., Austin, grading, small drainage structures 4.914 mi. Hy. 4, WPG 616-E, Menard Co., to Hannah & Hall, Professional Bldg., Waco, $65,832. Est. $40,000. New **P.W.A.** Noted Nov. 25, C. D.

Utah—State Rd. Comn., Salt Lake City, grading, draining, graveling 2.641 mi. road in Iron and Washington Counties, to J. W. Whiting, Springville, $76,154. Est. $67,800. Bids Dec. 30.

Virginia—State Dpt. Hys., Richmond, concrete paving 4.261 mi. Northampton Co., to Brooke Constr. Co., Inc., Norfolk, $103,449 ***1.4 mi. Wythe Co., to J. A. Archer & Son, Wytheville, $38,919***1.28 mi. Lee Co., to Chandler Bros., Inc., Virgilina, $61,855. Grand total $204,223. Bids Dec. 30. Rejected bids Dec. 30, improving roads in Caroline Co. Noted Jan. 6, C. D.—Dec. 26, E. N.-R.

Washington—Office of L. V. Murrow, dir. Hys., Olympia, grading, crushed stone surfacing 0.9 mi. State Rd. 3, Sect. 1, U. S. Wks. Program Project WPH 124-B, Asotin Co., to G. D. Lyon & Co., 225 Hutton Bldg., Spokane, $33,911***grading, crushed stone surfacing 1.0 mi. County Rd., Quilcene Vicinity, U. S. Wks. Project WPSO 243-A, Jefferson Co., to Allen & Govan, Inc., Box 105, Olympia, $9,693*** grading, crushed stone surfacing 2.7 mi. County Rd., Mesa to Kahlotus, U. S. Wks. Project WPSO 238-A, Franklin Co., to C. E. Oneal Co., Inc., Stevenson, $8,179. Grand total $97,387. Noted Dec. 5, C. D.

Washington—Office of L. V. Murrow, dir. Hys., Olympia, crushed stone surfacing, bituminous surface treatment 21.4 mi. County Rd. Soap Lake to Coulee City, U. S. Wks. Project WPSO 197-A, Grant Co., to F. R. Hewett, 420 West 22nd Ave., Spokane, $110,556; grading, crushed stone surfacing 5.1 mi. State Rd. 6, Dalkena to Cusick, U. S. Wks. Project WPGH 193-H, Pend Orielle Co., to N. A. Degerstrom, 15 East 32nd St., Spokane, $109,905. Bids Dec. 3. Noted Nov. 29, C. D.

Washington—Office of L. V. Murrow, dir. Hys., Olympia, grading, crushed stone surfacing 4.7 mi. State Rd. 9 Malone to Elma, U. S. Wks. Project WPH 179-E, Grays Harbor Co., to R. O. Dail & Warren Bros., Inc., Box 444, Aberdeen, $55,871***grading, draining, crushed stone surfacing 5.6 mi. State Rd. 9, Sequim to Blyn, U. S. Wks. Project WPH 128-E and WPMH 138-F, Callaham Co., to Walker Constr. Co., 4540 South Adams St., Tacoma, $95,896***grading, constructing treated timber trestle 1.3 mi. County Rd. Lower Deadman Rd., U. S. Wks. Project WPSO 239-A, Garfield Co., to J. Tobin, East 2018 Boone Ave. S., Spokane $5,882. Grand total $157,649. Bids Dec. 20. Noted Dec. 17, C. D.—Dec. 19, E. N.-R.

Wash., Everett—City, paving 19th Ave. from Rucker to Walnut Sts., to E. J. Templeton, 2924 Lombard St., $60,886. Est. $62,676. **P.W.A.** Noted Dec. 27, C. D—Jan. 2, E. N.-R.

Wisconsin — State Hy. Comn., Milwaukee, graveling 3.635 mi. road in Manitowoc Co., to R. M. Murphy, Route 2, West DePere, $10,295***grading, draining 3.635 mi. Manitowoc Co., to Muth-Knechtel Co., Manitowoc, $23,686 ***grading, draining, surfacing 0.358 mi. road in Milwaukee Co., to Gumz-Switalski, 2065 South 18th St., Milwaukee, $72,977***11.335 mi. Rock Co., to W. J. Kennedy, Footville, $11,173***0.789 mi. Green Lake and Waushara Counties, to T. Froeming Sons, 3116 North Humboldt Ave., Milwaukee, $5,349***road in Portage Co., to A. J. Pagel, Almond, $33,904 ***1,773 mi. Trempealeau Co., to Williams & Williams, Strum, $13,819***4.100 mi. Florence Co., to R. McCarty, 202 Catherine St., Kaukauna, $31,813***grading, draining 4.965 mi. Langlade Co. and 0.53 mi. Bayfield Co., to H. S. Kaliher, Washburn, $41,976 and $56,610 respectively***3.261 mi. in Richland Co., to Legreid Constr. Co., Stoughton, $18,645. Grand total $320,248. Bids Dec. 10 and 20. Noted Nov. 26, Dec. 9, C. D.—Dec. 5 and Dec. 12, E. N.-R.

†**Alaska**—Pub. Rds., graveling Seward Hy., to Siems Spokane Co., Realty Bldg., Spokane, Wash., $107,034.

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†*Federal Government.*

EARTHWORK, IRRIGATION DRAINAGE AND WATERWAYS

PROPOSED WORK

La., Leeville—Gulf Refining Co., Gulf Bldg., Houston, Tex., plans timber backfilled bulkheads in Bayou Lafourche at points on the right descending bank 760 ft., 1,555 ft. and 250 ft. below Hy. bridge at Leeville and points on left descending bank 810 ft. and 2,040 ft. below bridge in Lafourche Parish. Private plans.

N. Y., Breesport—Bd. Supervs. Chemung Co., Elmira, making plans constructing dam in Jackson Creek, Horseheads Twp., near here as part of Newtown Creek Flood Control. $70,000 or more. W.P.A. project. C. C. Hunter, Elmira, co. engr. Amberson Dam Co., 295 Madison Ave., New York, consult. engrs.

★ **†N. Y., New York**—U. S. Eng., Wash., D. C., plans straightening and deepening Harlem River Ship Canal, War Dpt. Applied for $700,000 federal funds.

★ **South Carolina** — South Carolina Public Service Authority allotted $5,500,000 loan for Santee-Cooper Project, incl. 2 reservoirs, power house 585 circuit mi. transmission system covering eastern half of state extending into North Carolina and Georgia, flood control facilities and mosquito control equipment. Loan is an addition to $500,000 allotment made recently and grant $4,500,000 available by W.P.A. Total cost $37,500,000. H. Flood and C. H. Moorefield, 521 Congaree Ave., Columbia, engrs. Noted Oct. 3, C. D.—Oct. 10, E. N.-R.

★ **Tex., La Feria**—La Feria Water Control & Impvt. Dist. 3, plans ordered rushed to completion for irrigation system. $574,500. Allotment made. A. Tamm, Harlingen, engr.

†Tex., Point Isabel—U. S. Eng. plans maintenance dredging to restore point Isabel Channel to Brazos Island Harbor, 25 ft. depth at mean low tide. $40,000 allotted.

BIDS ASKED

†T. H., Pearl Harbor—Yards & Docks, Navy Dpt., Wash., D. C., taking bids extending quay wall of rein.-con. on concrete piles, Spec. 8014. (Date not set.)

CONTRACTS AWARDED

†Arkansas — U. S. Eng., Vicksburg, Miss., constructing 100,000 cu.yd. earthwork in Arkansas River, to Forcum James Co., Dyersburg, Tenn., $19,000. Bids Dec. 11. Noted Nov. 27, C. D.—Dec. 5, E. N.-R.

Calif., Seal Beach—City Council, constructing rock breakwater, Anaheim Bay, to Rohl-Connolly Co., 4351 Valley Blvd., Los Angeles, $71,-162. Est. $82,000. P.W.A. Bids Jan. 2. Noted Dec. 27, C. D.—Apr. 11, E. N.-R.

Conn., New Haven — See "Industrial Buildings."

Maryland—Caroline Co. (Denton) and Queen Anne Co. (Centerville) constructing Long Marsh Ditch between Caroline and Queen Anne Counties to improve drainage for 45,000 acres of land, work done by CCC camp at Goldsboro, under supervision of Wm. J. Frere, Jr., engr., Goldsboro. Est. $225,000.

†Md., Ocean City—U. S. Eng., Baltimore, dredging 611,700 cu.yd. for fishing harbor, at West Ocean City, to Delaware Dredging Co., 139 South 3rd St., Phila., Pa., $54,831.

Mo., Parma—Drainage Dist. 28, New Madrid Co., G. M. Meier, secy., reclamation work to Rouse Constr. Co., Cape Girardeau, $54,677. P.W.A. Bids Oct. 25. Noted Oct. 16, C. D.—Sept. 26, E. N.-R.

†Montana—U. S. Eng., Kansas City, Mo., terminated existing contract with Silas Mason, 550 5th Ave., New York and Walsh Constr. Co., 114 West 3rd St., Davenport, Ia., for constructing tunnels at Fort Peck Dam. Under revised plans tunnels will be constructed by hired labor under owner. Noted Apr. 17, 1934, C. D.—Apr. 19, 1934, E. N.-R.

New Jersey—Bd. Commerce & Navigation, Trenton, constructing steel sheet pile jetty in Delaware Bay, Middle Twp., Cape May Co., to Gray Constr. Co., Franklin St., Morristown, $14,700. Noted Jan. 6, C. D.—Jan. 9, E. N.-R.

N. J., Forked River—City, steel sheet pile bulkheads and timber wharf at Inland Waterway Terminal, Forked River Basin, Ocean Co., to Gray Constr. Co., Franklin St., Morristown, $4,553. Bids Dec. 23. Noted Dec. 11, C. D.—Dec. 19, E. N.-R.

†New York—U. S. Eng., New York, dredging 63,200 cu.yd. from Peconic River, to Riverside Constr. Co., Main Dr., Riverhead, $17,993. Bids Oct. 21. Noted Oct. 7, C. D.—Oct. 10, E. N.-R.

†Oregon—U. S. Eng., Portland, clearing, excavating, rock rip rap for breakwater channel, near Bonneville, to General Constr. Co., 3840 Iowa Ave., Seattle, Wash., $20,170. Bids Dec. 12. Noted Jan. 3, C. D.

★ **Tex., Eagle Pass—Maverick Co. Water Control & Impvt. Dist. c/o E. H. Schmidt, secy.,** Eagle Pass, constructing main and lateral canals and appurtenant structures, to Hardwick Constr. Co., Sterrick Bldg., Memphis, Tenn., $1,474,676. Est. $1,600,000. P.W.A. Bids Dec. 14. Noted Dec. 20, C. D.—Dec. 26, E. N.-R.

Tex., Mission—Bd. Directors Hidalgo Co. Water Control & Impvt. Dist. 6, M. L. Hays, pres., irrigation system, incl. concrete-lined canals, pumping equipment, concrete water conveyors, etc., to V. Falbo & F. Falbo, 107 Morales St., San Antonio, $277,543. Est. $350,-000. P.W.A. Bids Dec. 14. Noted Dec. 30, C. D.

UNCLASSIFIED

PROPOSED WORK

Calif., San Jose — SWIMMING POOL — San Jose Country Club, J. L. Haskins, chn. Building Comn., plans by Binder & Curtis, 35 West San Carlos St., 35x75 ft., rein.-con. swimming pool with filter equipment, etc.

Calif., Santa Barbara—SWIMMING POOL—City plans by H. Howell, 157 Cheltenham Dr., outdoor swimming pool. To exceed $100,000. W.P.A. project. Voted $39,000 bonds. Noted Sept. 20, C. D.—Sept. 26, E. N.-R., under "Public Buildings."

Conn., Bristol—PARK IMPROVEMENTS—City, Park Dept., plans park improvements at Page Park, incl. recreation building, containing showers and equipped with lockers. $50,000. C. W. Buel, City Hall, engr. De Witt Page donated $50,000 for improvements.

Conn., New London—PIER IMPROVEMENTS—State, W. E. Clark, State Pier, rejected bids Dec. 13, improving State Pier. $60,000. Will revise and refigure. P.W.A. project. Noted Jan. 2, C. D.—Dec. 12, E. N.-R.

★ **Kan., Topeka** — RAILROAD IMPROVEMENTS—Atchison, Topeka & Santa Fe R. R., G. W. Harris, ch. engr., Chicago, Ill., plans expending $28,400,000 (provided by budget), for equipment, repairs and improvements.

Me., Bar Harbor—HANGAR—Town, L. Abbott, chn. Bd. Selectmen, Town Hall, plans by Bunker & Savage, 250 Water St., Augusta, 1 story hangar building. To exceed $40,000.

Mich., Detroit—AIRPORT—City plans constructing airport, parking lot and driveway, laying drainage tile, constructing firewalls in hangar, Gratiot Ave. $300,000. W.P.A. project. R. W. Snoke, Detroit City Airport, engr.

Mo., Maplewood (St. Louis P. O.)—SWIMMING POOL, etc.—City, J. Fels, mayor, election Jan. 21, $35,700 bonds for rein.-con. swimming pool, bath house and necessary equipment. $37,000. B. Hutchinson, city engr.

★ **Nevada**—TRANSMISSION LINE, etc.—Lincoln Co. Power Dist., Pioche, preliminary plans constructing Boulder-Pioche power transmission line and sub-station. $900,000. District Bd. accepted federal government grant of $336,000 and agreement to purchase $246,000 of district's bonds. Noted Aug. 1, C. D.—Aug. 8, E. N.-R.

N. J., Wharton—ATHLETIC FIELD—Town plans enlarging athletic field. $25,870. Funds approved by W.P.A. J. H. Moroney, 2 Park Square, city engr.

★ **New York** — TUNNEL — New York Tunnel Authority, authorized by State Legislature for Queens Midtown Tunnel Authority, to construct 38th St.-Long Island City Tunnel. $58,-365,000 allotted by Federal Government. Also to construct Hamilton Ave.-South Ferry Tunnel, in event funds are available. Noted Jan. 6, C. D.—Jan. 9, E. N.-R.

★ **N. Y., New York**—BATHING PAVILION, etc.—Park Dpt., Arsenal Bldg., Central Park, plans by A. Embury, 3rd, c/o owner, constructing 2 story, brick bathing pavilion, promenades and offices. $1,700,000.

Okla., Bethany—TRANSMISSION LINES—E. W. Baker & Co., Bethany, final plans made constructing electric transmission line from Bethany to Piedmont with feeder lines totalling 70 mi. $40,000. H. D. Grant, Bethany, engr.

★ **Tex., Baytown**—PIPE LINE—Humble Pipe Line Co., Baytown, plans pipe line to transport mixture of natural gasoline, butanes and propane from East Texas fields to Baytown refinery, 8 in. welded joints. $1,000,000. Private plans. Interested contractors and dealers communicate with owners immediately.

†Tex., San Antonio—FLYING FIELD—U. S. Eng. plans improving local flying centers, incl. runways, shop, light hangars, etc. $77,040. Project approved.

Utah, Salt Lake City—AIRPORT—City plans enlarging and improving municipal airport, incl. concrete runways, new hangar, etc. $50,-000. W. D. Beers, city engr.

Va., Norfolk—FERRY TERMINAL—Norfolk County Ferries, Ferry Terminal, plans repairing and altering ferry terminal. Est. about $50,-000. Architect not appointed.

Wash., Seattle — AIRPORT — King Co. plans improving Boeing Field Airport, incl. draining, grading, surfacing 600 acre field with asphalt base, new runways, one 3,000 ft. and one 7,000 ft. long, installing border lights. $493,000. W.P.A. funds allotted. J. P. Dodd, County-City Bldg., engr.

B. C., Cariboo—POWER DEVELOPMENT—Cariboo Hydro-Electric Power Co. Ltd., prepares plans power development at Swamp River. $50,000.

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†Federal Government.

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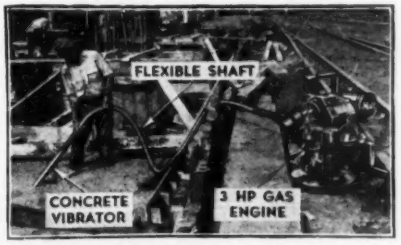

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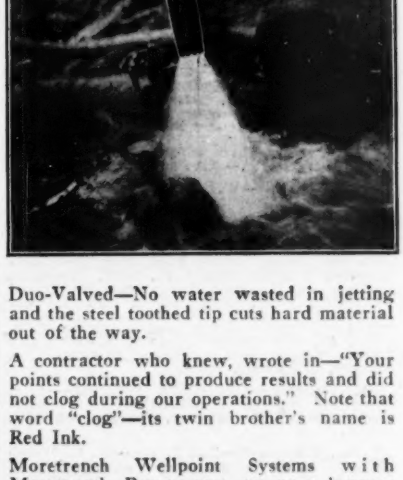

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Unclassified (Continued)

★ **Ont., Sault Ste. Marie**—POWER DEVELOPMENT—Great Lakes Power Co. Ltd., Sault Ste. Marie, soon takes bids constructing new power project on Montreal River, 90 mi. from here, to take care of new development of industry in the Michipicoten mining area. $1,000,000.

BIDS ASKED

Calif., Los Angeles—SUBWAY—Feb. 5, by Bd. P. Wks., constructing Macy St. subway, rein.-con., 2 hinge arch type, 68 ft. wide, 505 ft. long, 17 ft. clearance, 18,870 cu.yd. earth excav., 10,174 cu.yd. rein.-con., 1,280 tons reinforcing steel, etc. $368,000. L. Aldrich, city engr. Noted Jan. 6, C. D.—Jan. 9, E. N.-R.

Illinois — RURAL ELECTRIFICATION — See "Contracts Awarded."

Me., Bar Harbor—HANGAR—See "Contracts Awarded."

N. Y., Hornell—RURAL ELECTRIFICATION—See "Contracts Awarded."

N. Y., New York—RECREATION BUILDING—See "Contracts Awarded."

Pa., Pittsburgh—AIRPORT—Jan. 21, by R. G. Woodside, controller Allegheny Co., 3 separate bids, furnishing, installing, piping, gasoline service pits; extending and changing concourse; electric work extending and changing concourse and gasoline service pits, for municipal airport, near here, Mifflin Twp. P. H. Martin, Pittsburgh, engr.

N. B., St. John—OIL TANKS—Provincial Oils Ltd., Hilyard St., taking bids constructing two 150,000 gal. oil tanks.

CONTRACTS AWARDED

†**D. C., Wash.**—FIELD HOUSE, etc.—National Park Service, Wash., D. C., altering field house and pool, to B-Z Contg. Co., 52 Vanderbilt Ave., New York, N. Y., $53,740. Bids Nov. 21.

Illinois—RURAL ELECTRIFICATION—Suburban Electric Co., Dunlap, Ill., constructing 98 mi. rural electrification in Knox, Peoria and Stark Counties, day labor and separate contracts. $82,000. Noted Dec. 31, C. D.—Jan. 9, E. N.-R.

Me., Bar Harbor—HANGAR—Town, L. Abbott, chn. Bd. Selectmen, 1 story, steel hangar, concrete found., in Trenton. Work started by owner, under W.P.A. To exceed $40,000. Bunker & Savage, 256 Water St., Augusta, archts. Noted Dec. 31, C. D.—Jan. 9, E. N.-R.

Miss., Okolona—POWER LINE EXTENSIONS—City, Mayor and City Council, City Hall Bldg., constructing electric power line extensions, to S. C. Irby, Jackson, $9,984••• to T. J. Moss Tie Co., Columbus, $5,718••• to Moore Handley Hardware Co., 25 South 20th St., Birmingham, Ala., $2,092 and $2,713 respectively•••to Tennessee Valley Electric Supply Co., Pontotoc, $739 and $315 respectively. Grand total $21,561. Total est. $38,181. **P.W.A.** Bids Dec. 2. R. L. Wine, Okolona, engr.

★ **New York**—TUNNEL—Port of New York Authority, 111 8th Ave., New York, constructing New Jersey Rock Tunnel Section MHT 5-A, for New Jersey Land Sections and Plaza, to Underpinning & Foundation Co., 155 East 44th St., New York, $1,103,505•••and New Jersey Steel Bent Sections and Plaza, MHT 5-B, to G. M. Brewster & Co., 11 West 42nd St., New York, $2,654,053, both of Midtown Hudson Tunnel. **P.W.A.** Bids Dec. 19. Noted Dec. 19, C. D.—Dec. 26, E. N.-R.

New York—TURNSTILE EQUIPMENT—Bd. Transportation, J. H. Delaney, chn., 250 Hudson St., New York, over 100 turnstiles to be installed in Lines D and E of New York City Independent Subway, to Perey Mfg. Co., 101 Park Ave., New York, $59,355. Bids Nov. 29. Noted Dec. 2, C. D.—Nov. 21, E. N.-R.

N. Y., Hornell—RURAL ELECTRIFICATION—New York Electric Co., Hornell, rural electrification, in vicinity of here, by day labor and separate contracts. To exceed $50,000.

N. Y., New York—RECREATION BUILDING, etc.—Dpt. Parks, Central Park, New York, constructing 1 story, 20x52 ft., brick recreation building at Macombs Dam Park, to exceed $11,000; 1 story, brick comfort station, Cedar Ave. and 178th St., $18,000; and 1 story, 26x54 ft., brick comfort station, Devoe Park, 188th St. and University Ave., $15,000, day labor. Owner will purchase materials. A. Embury, c/o owner, archt.

O., Wellston — LIGHTING SYSTEM — City, boulevard lighting system, Contr. 1, general section, to H. F. Brennan, Newark, $33,933. **P.W.A.**

★ **Pa., Pittsburgh**—LAKE, etc.—R. G. Woodside, controller Allegheny Co., constructing lake and dam, road around same and connections with Babcock Blvd., North Park, McCandless Twp., to Harrison Constr. Co., 1101 Western Ave., N. S., $1,046,551•••boat house, North Park Dam, to P. K. Constr. Co., 30 East General Robinson St., N. S., $53,591•••plumbing, to Moss & Blakely Co., 223 Beltzhoover Ave., $3,287•••electrical work, to McNeil Electric Co., 5902 Kirkwood St., $5,650. Grand total $1,109,079. **P.W.A.** Bids Dec. 3. Noted Dec. 12, C. D.—Dec. 19, E. N.-R.

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Tex., Lubbock—STADIUM——Texas Technological College, Dr. B. Knapp, pres., brick, rein.-con. stadium, plain found., to McMullen & Field Bros., Lubbock $104,836. **P.W.A.** Noted July 2, C. D.—July 11, E. N.-R.

Wash., Olympia—WHARF—Port of Olympia, constructing addition to Transit Shed "B" wharf repairs, to H. R. Olsen, 4040 Pacific St., Tacoma, $31,209. **P.W.A.** Noted Jan. 8, C. D.

Ont., London—GAS MAINS—City Gas Co., W. Duffield, genl. mgr., Dundas St., laying mains in suburbs. Work will be done by company's men. Est. $50,000. Noted Sept. 27, C. D.—Oct. 3, E. N.-R.

MATERIALS AND EQUIPMENT

PROPOSED WORK

FIRE FIGHTING EQUIPMENT — **Stockton, Calif.** — City, election Feb. 18, for bonds to finance purchase of fire fighting equipment, motor apparatus, etc.

MOTOR TRUCKS, etc.—**Hartford, Conn.**—City plans purchasing 15 additional motor trucks to replace teams in motorization of ash and rubbish collection, $60,000; 1 additional motor street sweeper, $6,000. L. Peck, supt. Streets.

STEEL TANKS—**Muskegon, Mich.**—Naph-Sol Refining Co. plans installation two 25,000 bbl. steel tanks for storage at crude oil refinery. To exceed $1,000.

PUMPER—**Austin, Minn.**,—City, F. R. Smith, clk., plans purchasing new pumper for Fire Dpt.

FIRE TRUCK, etc.—**Stillwater, Minn.**—City, C. A. Lammers, clk., plans purchasing fire truck and booster pump equipment. J. McGann, ch. Fire Dpt.

STEEL TANK—**St. Louis, Mo.**—Bondall Co., c/o 500 Bittner St., granted permit by Bd. P. Service to install one 12,000 gal. underground steel tank for gasoline for private use at 500 Bittner St.

TANK—**St. Louis, Mo.**—Bondall Co., 500 Bittner St., applied to Bd. P. Service, for permit to install one 12,000 gal. underground steel tank for gasoline, 500 Bittner St.

FIRE EQUIPMENT—**Polson, Mont.**—City, R. B. Davidson, clk., plans purchasing fire department equipment.

STEEL TANKS—**Batavia, N. Y.**—W. D. Walbridge, Route 5, plans installing two or three 500 gal. steel tanks, electric pump, etc., at gasoline service station. To exceed $1,000.

ROAD MACHINERY—**Binghamton, N. Y.**—Bd. Supervs. Broome Co., plans purchasing road machinery and repairing and maintaining present equipment. $39,032 appropriated.

GASOLINE TANKS, etc.—**New York, N. Y.**—Metropolitan Savings Bank, 754 Bway., New York, will purchase 500 and 1,000 gal. underground gasoline tanks, service pumps and shop equipment for 1 story, garage, 434 West 19th St. A. A. Tearle, 10 West 46th St., New York, engr. and archt.

TANK—**Oswego, N. Y.**—E. F. Welden, 163 East 9th St., plans purchasing steel gasoline storage tank for gasoline service station, Bridge and Liberty Sts. $1,000. C. H. Fournier, 35 Mohawk St., Oswego, engr.

LOADING PLANT—**Johnstown, Pa.**—Johnstown Coal & Coke Co., c/o C. E. Evans, plans constructing modern coal tipple, loading plant and tipple. To exceed $1,000.

STEEL TANKS, etc.—**Phila., Pa.**—Socony-Vacuum Oil Co., Inc., 58th St. and Schuylkill River, plans installing 500 gal. steel tanks and electric pumps at gasoline service stations to be built at Chew St. and Washington Lane, and at Levick St. and Rising Sun Ave. To exceed $1,000.

TANKS — **Phila., Pa.** — Socony-Vacuum Oil Co., 58th St. and Schuylkill River, plans installing 500 gal. steel tanks and electric pumps at gasoline service station, 10th and Rittner Sts. To exceed $1,000.

TANKS, etc.—**Williamsport, Pa.**—J. Stahlnecker, 406 Cemetery St., plans installing two 500 gal. steel tanks and electric pump at gasoline service station to be established in Newberry Block. To exceed $1,000.

QUARRYING MACHINERY — **Kingston, Ont.** —Frontenac Quarries Ltd., J. C. Reynolds, pres., will soon be in market for quarrying machinery, etc.

ROCK CRUSHER—**Whitvale, Ont.**—Pickering Twp., D. R. Beaton, interested in prices of rock crusher.

BIDS ASKED

STRUCTURAL STEEL RADIAL GATES—**Los Angeles, Calif.**—Jan. 27, by Directors Metropolitan Water Dist., 306 West 3rd St., F. E. Weymouth, engr., furnishing 8 structural steel radial gates for wasteways, Schedules 1 and 2; furnishing 8 hand-operated hoists for same, Schedules 3 and 4, in connection with Colorado River Aqueduct, Spec. 141. To exceed $5,000.

GENERATING SETS—**Chicago, Ill.**—Feb. 6, by Sanitary District of Chicago, 910 South Michigan Ave., purchasing oil engine driven generating units and various accessories. P.W.A. project.

STREET FLUSHER—**Evansville, Ind.**—Jan. 24, by Bd. P. Wks., City Hall, 1,500 gal. motor driven elliptical tank street flusher, capable of carrying 16,000 lb., filled with water, separate 50 lb. pressure booster pump, 3 flusher nozzles, several sprinkler nozzles, separate filling attachment for 20 lb. lift, water meter, [illegible] gage, pressure gages, 15 ft. filling hose. [illegible] H Bosse, ch.

†PIPE LINE DREDGE—**Paducah, Ky.**—Jan. 21, by U. S. Eng., P. O. Box 59, Louisville, constructing and delivering afloat 1 self-propelled 20-in. pipe line dredge.

†CRAWLER TYPE EXCAVATORS—**Eastport, Me.**—Jan. 20, by U. S. Eng., 2 crawler type excavators.

†MILLWORK—**Eastport, Me.**—Jan. 23, by U. S. Eng., millwork complete for hospital.

SAND, etc.—**Baltimore, Md.**—Jan. 22, by Bd. Awards, Municipal Bldg., furnishing, delivering sand, gravel, crushed stone and cinders to Dpt. P. Wks.

†CREOSOTED PILING — **Vicksburg, Miss.** — Feb. 4, by U. S. Eng., P. O. Bldg., Vicksburg, creosoted piling.

†DRY OAK LUMBER—**Vicksburg, Miss.**—Feb. 6, by U. S. Eng., common dry oak lumber.

†LUMBER — **Vicksburg, Miss.** — Feb. 6, by U. S. Eng., Box 667, 3,010 ft. B. M. dry cypress lumber.

TRACTOR—**Panama, N. Y.**—Town Bd. North Harmony, taking bids furnishing motor driven tractor for highway work. $2,000. S. H. Cook, in charge.

PIPE, etc.—**Cincinnati, O.**—Jan. 22 (extended date), by C. E. Lex, city purch. agt., vitr. sewer pipe, fittings and diam. tile. Noted Dec. 18, C. D.

REFLECTOR SIGNAL ACCESSORIES—**Cincinnati, O.**—Jan. 24, by C. E. Lex, city purch. agt., reflector signal accessories to Dpt. Hy. Maintenance.

CONVEYORS—**Grove City, Pa.**—H. L. Uber, R.F.D. 3, in market for steam boiler, steam engine, hoist, conveyors and other equipment for coal mining development.

STONE, SAND, etc.—**Lancaster, Pa.**—Jan. 24, by W. J. Coulter, city clk., furnishing crushed stone, concreting sand, bricklaying sand, common hard brick, paving brick, Portland cement, quick setting cement, iron castings, rein.-con. pipe, terra cotta pipe, bituminous oils and tars, cold patch, cold surface treatment, gasoline, kerosene, fuel oil, liquid chlorine, high calcium hydrated lime.

†METAL WORK—**Knoxville, Tenn.**—Jan. 28, by Tennessee Valley Authority, Knoxville, architectural metal work, consisting of aluminum sash and doors for Wheeler Control Building, C. H. Garity, dir. Purchases.

†SWITCHBOARDS, etc.—**Knoxville, Tenn.**—Jan. 30, by Tennessee Valley Authority, Knoxville, furnishing, assembling, selling and delivering auxiliary switchboards for Norris Power Plant. C. H. Garity, dir. Purchases.

TRANSFORMERS, etc.—**Amos, Que.**—J. P. Norrie, P. O. Box 187, in market for two 200 hp. transformers with switching equipment for 3 phase, 25 cycle power, 12,000 to 550 volts, 1 electrically operated air compressor 500 cu.ft. delivered, 1 electrically driven hoist with motor not less than 50 hp. complete with switching equipment, 4 sinking drills 3½ in., 1 portable saw mill electrically operated, three 1 ton sinking buckets, two 1 ton ore cars, rails, tools, etc.

FIRE APPARATUS—**Outremont, Que.**—Municipality, M. Willis, fire chief, in market for fire apparatus. $2,125 available.

CONTRACTS AWARDED

†BELT CONVEYOR—**Los Angeles, Calif.**—U. S. Eng., 751 South Figueroa St., furnishing 1 belt conveyor system, f.o.b. San Gabriel, to California Conveyor Co., 1339 Sante Fe Ave., $5,384. Bids Dec. 20, awarded Dec. 28. Noted Jan. 3, C. D.

†BRICK, etc. — **Los Angeles, Calif.** — U. S. Eng., 751 South Figueroa St., 5,416,000 brick, for Kenter Canyon Project, to Gladding McBean Co., 2901 Los Feliz Blvd., $125,300••• two 2 cu.yd. capacity power shovels, Diesel engine driven, crawler type, to Osgood Co., Marion, O., $35,500. Bids Dec. 23, awarded Jan. 3.

†COARSE AGGREGATE—**Los Angeles, Calif.**—U. S. Eng., 751 South Figueroa St., to Commercial Rock Co., Upland, 20,100 cu.yd. 1½- to ¾-in.; 24,570 cu.yd. ¾ in. to No. 4 mesh coarse aggregate and 24,620 cu.yd. sand, $148,818••• to Blue Diamond Co., Western Rock Products and Piru Rock Co., c/o Blue Diamond Co., 1650 South Alameda St., 13,185 cu.yd. 1½- to ¾-in. and 16,115 cu.yd. ¾ in to No. 4 mesh coarse aggregate, 15,170 cu.yd. sand, Lot 1; 15,170 cu.yd. 1½- to ¾-in. and 18,545 cu.yd. ¾ in. to No. 4 mesh aggregate and 18,580 cu.yd. sand, Lot 2; 8,080 cu.yd. 1½- to ¾-in. and 9,874 cu.yd. ¾ in. to No. 4 mesh coarse aggregate and 9,895 cu.yd. sand, Lot 9, $241,831. Bids Dec. 6.

†CREOSOTED PILES—**Los Angeles, Calif.**—Treas. Dpt., Procurement Div., 1205 South Santee St., 3,400 lin.ft. 20 ft. creosoted piles, to J. H. Baxter Co., 601 West 5th St., $1,513.

★ †STEEL REINFORCING BARS—**Los Angeles, Calif.**—U. S. Eng., 751 South Figueroa St., 15,137 tons steel reinforcing bars, to Los Angeles Iron & Steel Co., 1522 Sante Fe Ave., $721,656. Bids Dec. 5, awarded Dec. 26.

†STEEL PROPELLORS—**Kansas City, Mo.**—U. S. Eng., 232 Mfg. Exch. Bldg., furnishing 12 steel propellors, f.o.b. contractor's plant, to Sheriffs Wheel Co., 141 South Water St., Milwaukee, Wis., $1,600. Bids Dec. 2, awarded Dec. 30.

†Federal Government.

Materials, etc. (Continued)

†TRUCKS—**Kansas City, Mo.**—U. S. Eng., 232 Mfg. Exch. Bldg., Kansas City, 6 trucks with stake bodies, 157 in. wheel base, 200 cu.in. gasoline engines, to Miller Chevrolet Co., St. Louis, $4,452. Bids Dec. 20. Noted Jan. 7, C. D.

†STEEL RAILS — **St. Louis, Mo.** — **Wabash** Railway Co., E. L. Crugar, ch. engr., Railway Exch. Bldg., c/o N. B. Pitcairn and F. C. Nicodemus, Jr., receivers, 10,000 tons steel rails, to Carnegie Illinois Steel Co., Carnegie Bldg., Pittsburgh, Pa.; to Inland Steel Co., 38 South Dearborn St., Chicago, Ill.; and to Bethlehem Steel Co., Bethlehem, Pa.

†DERRICK BOAT—**New York, N. Y.**—U. S. Eng. Army Bldg., New York, constructing afloat one 65 ton derrick boat, to Bethlehem Shipbuilding Co., Bethlehem, Pa., $115,300. Bids Nov. 7. Noted Oct. 8, C. D. — Oct. 24, E. N.-R.

†STRUCTURAL STEEL—**New York, N. Y.**—State Procurement Officer, Treas. Dpt., 118th Ave., New York, 200 tons structural steel for Orchard Beach, to Belmont Iron Wks., Eddystone, Pa.

GRAVEL, SAND, etc.—**Cincinnati, O.**—City, 3,750 tons gravel aggregate and 4,000 tons concrete sand for Maintenance Dpt., 1,500 tons concrete sand for Miscellaneous Dpt., 1,000 tons coarse sand, 2,300 tons bank or river sand, to G. L. Rack, Estate Ave., $4,500 and $7,580 respectively•••4,000 tons lake sand, to J. Mueller Co., 321 East Wyoming Ave., $2.35 per ton, total $9,400•••950 tons filter dust in sacks, to Piqua Stone Products Co., at $4.59 per sack, total $4,361•••160,000 gal. fuel oil, to Eaton Oil Wks., Sterrett St. & L. & N. R. R., $11,136•••300 tons paving pebbles and 5,000 tons fine bank or river sand, to North Cincinnati Sand & Gravel Co., Cincinnati, $450 and $6,000 respectively•••18,000 tons crushed and special gravel, and 900 tons crushed boulder screenings, to Van Camp Stone Co., 2nd Natl. Bank Bldg., $25,128•••2,650 cu.yd. premixed concrete, to Hilltop Builders Supply Co., North College Hill Yd., $15,958. Grand total $84,513. Noted Dec. 12, C. D.

PORTLAND CEMENT—**Cincinnati, O.**—City, furnishing 9,000 bbl. portland cement, to Moores-Coney Co., Temple Bar Bldg., $21,605.

LUMBER—**Spokane, Wash.**—City, 300 M ft. lumber, to Spokane Sash & Door Co., North 825 Superior Ave., $7,346. A. D. Butler, City Hall, engr. Noted Jan. 9, C. D.—Jan. 16, E. N.-R.

CEMENT—**Milwaukee, Wis.**—Milwaukee Co. Hy. Dpt., 8,500 bags Portland cement, to Tews Lime & Cement Co., 1136 East North Ave., $1,957 per bbl. net. Bids Jan. 3, awarded Jan. 3.

FOREIGN

Egypt, Cairo—Ministry of Public Wks., taking bids supplying 1 electric water level indicator and recorder; workshop machinery comprising belt planing machines, precision lathe, etc., Diesel engine driven d/c generator, switchboard, reduction gears, artesian well, etc.•••Egyptian State Domains Administration taking bids 2 presses for pressing and baling rice straw, and for 2 petrol motors of at least 20 hp.; 2 threshing machines not exceeding 45 ft. in width and 3 portable engines with braking power of not less than 20 hp. or more than 40 hp.

Egypt, Cairo—Ministry of Public Wks., taking bids 30 petrol and paraffin pumping sets.

England—G. W. V. De Rhe Philipe Madras and Southern Mahratta Ry. Co., 25 Buckingham Place Rd., Westminister, in market for 637 tons of M.S. rounds, squares, angles and flats, and for 370 tons M.S. plates and sheets, 355 steel tires for locomotives, broad gage, 238 steel tires for locomotives, metre gage, 3,320 steel boiler tubes and 228 steel flue tubes, solid drawn. **London**•••Wallis Gilbert & Partners, archts., Central Chambers, Buckingham Palace Rd., **London**, preparing plans $600,000 extension for MacLean Ltd., Great West Rd., Brentford•••Courtaulds, Ltd., 16 St. Martins le Grand E.C., **London**, making plans factory at Holywell, $1,000,000•••Fresh Wharf Ltd., **London**, preparing plans new wharf and warehouses, $530,000•••C. W. Hodgson, archts., 203 Hoe St., **London**, preparing plans large factory at Walthamstow•••Gunton & Gunton, archts., Empire House, St. Martins le Grand, preparing plans plant extension for Ault & Wiborg, Stanclew Rd. S.W., **London**, $650,000•••Wallis, Gilbert & Partners, archts., Central Chambers, Buckingham Palace Rd., **London**, preparing plans plant at Point Pleasant, for Aluminum Paint & Vessel Ltd., $600,000•••Courtaulds Ltd., 16 St. Martins le Grand E.C., **London**, preparing plans factory at Plymouth, $1,250,000••• Thames Bd. Mills Ltd., **London**, purchased site at Arpley, for plant, J. Simpson, c/ Unilever Ltd., Unilever House E.C.•••First National Housing Trust, 10 The Boltons S.W., **London**, preparing plans 314 houses at Corby, $628,000•••John Laing & Sons, Ltd., Mill Hill N.W., **London**, prepares plans 770 houses construction at Edgware, $1,100,000•••General Housing Co. Ltd., 59 Uxbridge Rd. W., **London**, prepares plans 265 houses at Hesten•••Gordon Carrington Co., 1 Park Pl., **London**, prepares plans 350 houses at Hounslow, $700,000••• University of London, **London**, constructing students' hotel, to **Ashby Horner Ltd.**, 8 Aldgate East, $500,000, Sir H. Baker, Romney House, Marsham St. S.W., archt.•••**Worthing** Municipality voted $5,000,000 for civic improvements, incl. 200 houses, $500,000; drainage scheme, $1,000,000; and water scheme, $750,000•••**Goring** Municipality voted $32,500,000 civic improvements, incl. 27 mi. pavement, $2,500,000•••**Angmering** Municipality voted $10,000,000 for civic improvements, incl. golf club house, $200,000•••**Seaford** Municipality voted to develop 1,000 acre tract for housing purposes•••**Southwick** Municipality voted to develop 450 acre estate for housing purposes•••Scunthorpe & Frodingham Urban District Council, **Scunthorpe**, taking bids supplying and erecting electrically driven pumping plant, incl. 2 motor driven centrifugal bore hole pumps, and 3 horizontal motor driven turbine type force pumps with all pipes and accessories. W. Farrar, engr.

England—Feb. 25, by G. F. Stringer, clk. Metropolitan Water Bd., 173 Roseberry Ave. E.C., **London**, for supplying and erecting 8 steam turbines with centrifugal pumps, electrical generators and appurtenances•••H. Waugh & Co., Ltd., 2 Pepys St., Seething Lane E.C., **London**, in market for lathe, 20 ft. long, 10 ft. diam. tumbler in center, 15 ton weight •••Malmesbury Joint Isolation Hospital Comn., **Chippenham**, plans new ward block, $600,000 •••Wates Malden Ltd., **Turckenham**, plans 318 houses at Meadway, $736,000•••**Oxford** Municipality voted $419,750 for new isolation hospital•••**Brighton** Municipality plans by W. N. C. Chinch, Castle Sq., new electrical station at Monbsecoombe•••Great Western Ry., **Swansea**, plans office block, $1,000,000•••London County Council, **London**, purchases 434 acre site at Chigwell for housing scheme, $2,000,000 •••**Middlesex** Education Council, 10 Great George St. S.W., plans technical institute at Tuckenham, $500,000•••Davis Estates Ltd., **Kilburn**, plans 174 houses at Rugby, $458,000 •••His Majesty's Office of Works, King Charles St. S.W., **London**, plans telephone exchange at Painswick•••Walter Moon, town clk., **Liverpool**, taking bids for 120 tons c.i. pipe••• Corporation of Liverpool, Wester Moon, town clk., **Oswestry**, taking bids constructing 4 filter beds•••H. A. Hield, town clk., **Torquay**, taking bids supplying and erecting 20 vertical pressure filters, 8 ft. diam. and electrically driven centrifugal booster pumps of 104,000 gal. per hr. capacity•••I. N. Cule, town clk., **Skegness**, taking bids for supplying and laying 21,000 ft. 15 in. watermains, R. H. Jenkins, engr.

Iran, Teheran—Ministry of Posts & Telegraphs taking bids 8,680 steel telegraph poles and accessory equipment.

New Zealand, Wellington—New Zealand Post & Telegraph Dpt., taking bids supply one million 2x0.115 in. internal diam. and 600,000 2x0.165 in. internal diam. paper sleeves; supplying and delivering 4 tons soft solder; Feb. 19, by Dpt. P. Wks., supply of busbars, insulators and steel work.

New Zealand, Wellington—Feb. 13, by Director General Stores Dpt., General Post Office, supplying 500 junction blocks, 15 pr. without covers, and 150 junction blocks, 20 pr. with covers; Feb. 17, supplying 150 batteries, for Battery No. BB2; and Feb. 18, for supplying 50,000 cells telephone 1.5 volt.

Scotland, Glasgow — Municipality purchases Pollok Estate and plans erecting 4,000 houses.

South Africa—Southern African Railways & Harbours Administration, **Johannesburg**, 26 four ton electric portal luffing gib cranes, to Babcock & Wilcox, London•••Southern African Railways & Harbours Administration, T. H. Watermeyer, mgr., taking bids supplying 20,000 gal. pressed teel tank 20x20x8 ft. with supporting structure; South African Railways & Harbours Administration, 950 drop side trucks to Metropolitan Vickers, Ltd., Manchester, England, and for 500 short steel trucks to West Deutsche Koeen, Berlin, Germany, $4,750,000•••Southern African Union Tenders & Supply Bd., **Pretoria**, taking bids c.i. pipe for 1936-1937.

South Africa, Johannesburg—T. H. Watermeyer, mgr., South African Railways & Harbor Administration, taking bids for supplying vacuum and steam pressure gages and gage dials, quadrants and pinions.

PUBLIC BUILDINGS

PROPOSED WORK

†Ariz, Tucson — Vet. Bu., Arlington Bldg., Wash., D. C., rejected bids Dec. 27, constructing administration building addition. Noted Nov. 26, C. D.—Dec. 5, E. N.-R.

Calif., Barstow—Barstow Union High School Dist., plans by E. Chas. Parke, 657 North 8th St., Colton, combination auditorium and gymnasium building, classroom and administration and shop building. Est. $145,000. P.W.A. project. Noted Dec. 23, C. D.—Dec. 26, E. N.-R.

Calif., Los Angeles—Bd. Educ. plans by R. E. Coate, 701 Architects Bldg., new school building and auditorium building at Arlington Heights School, 1717 7th Ave. Est. $130,000. P.W.A. project.

Calif., Los Angeles—Los Angeles Bd. Educ., plans by Marsh, Smith & Powell, 508 Architects Bldg., new high school building, 1521 North Highlands Ave., at Hollywood High school site. $165,000. P.W.A. project.

Calif., Los Angeles—Los Angeles Bd. Educ. plans by T. F. Power, 1414 North Fuller Ave., new building at West Vernon Ave. School, 363 West Vernon Ave., $105,000; plans by K. MacDonald, Jr., 3305 Wilshire Blvd., new school building at Los Feliz School, 4737 Hollywood Blvd., $100,000; plans by R. Montgomery, 3828 Amesbury Rd., new building and auditorium at Buchanan St. School, 5011 Baltimore St., $120,000•••plans by Plummer, Wurdeman & Becket, 901-02 Architects Bldg., rehabilitation, strengthening, reconstruction of buildings 1 and 2 at Albion St. School, 322 South Avenue 18, $100,000. P.W.A. projects. O. G. Bowen, 1144 South Grand Ave., engr.

Kan., Kansas City—State rejected bids constructing Bell Memorial Hospital. $109,000. Noted June 28, C. D.—July 11, E. N.-R.

Kan., Mankato—City, P.W.A. funds rescinded for constructing power plant. $360,000. E. T. Archer & Co., 609 New England Bldg., Kansas City, Mo., engrs. Noted Dec. 16, C. D. —Dec. 19, E. N.-R.

Mass., Chelmsford—Town, R. Clough, chn. School Housing Comn., Town Hall, high school addition. $120,000. Town turned down P.W.A. grant. Await town meeting in March. Ashton & Huntress, 477 Essex St., Lawrence, archts. Noted May 23, C. D.—May 30, E. N.-R.

Mass., Everett—City, F. E. Lewis, mayor, City Hall, fire alarm system building. $157,000. Project voted down by City Comn. Eisenberg & Feer, 11 Beacon St., Boston, archts. Noted Sept. 13, C. D.—Sept. 19, E. N.-R.

Mass., Everett—City, F. E. Lewis, mayor, City Hall, city hall, Broadway and Church St. $497,000. Project voted down by City Council. Noted Jan. 16, C. D.—Jan. 24, E. N.-R.

Mass., Everett—City, F. E. Lewis, mayor, City Hall, voted not to build 1 story municipal garage. $49,000. Eisenberg & Feer, 11 Beacon St., Boston, archts.

Mass., Medford—City, at office of Mayor, City Hall, plans by M. A. Dyer Co., 1 Beacon St., Boston, and takes bids in February, brick, stone city hall, The Common. Est. $200,000.

Mass., Natick—Town, H. J. Johnson, chn. School Com., voted not to build high school addition. To exceed $150,000. Frank Irving Cooper Corp., 47 Winter St., Boston, archts. Noted Sept. 30, C. D.—Oct. 3, E. N.-R.

Mass., Springfield — City Comn., Municipal Bldg., rejected bids Dec. 12, for Forest Park and Junior High School, Oakland St. Being redigured. P.W.A. project. R. B. Warner, 129 Ingersoll Grove, and B. H. and H. M. Sebury, 21 Besse Pl., archts. Noted Dec. 19, C. D.—Nov. 21, E. N.-R.

Mass., Springfield—City, Comn. on City Property, City Hall, will not build for Buckingham Junior High School. Project abandoned. Noted Dec. 19, C. D.—Nov. 28, E. N.-R.

Mass., Westfield—Commonwealth of Massachusetts, Dpt. P. Health, State House, Boston, rejected bids Dec. 6, 2 story, basement, 28x67 ft., duplex house and 2 story, basement, 34x116 ft., men's dormitory addition, at State Sanatorium. Projects cancelled. Noted Dec. 26, C. D.—Oct. 17, E. N.-R.

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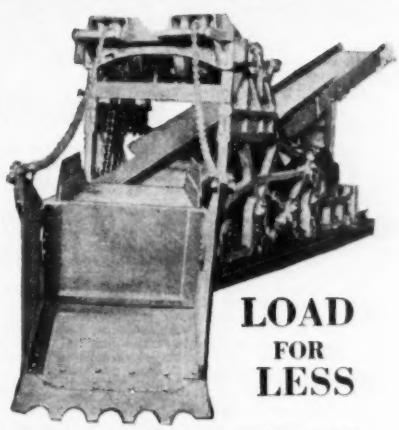

LOAD FOR LESS

ROCK TUNNEL RECORDS
Made With
CONWAYS

- **J. F. Shea Co.** ..... **Owyhee**
  12'x12' ..... 1319' Month
- **A. Guthrie & Co.** ..... **St. Paul, Minn.**
  14'x14' ..... 1466' Month
- **Mason Walsh Co.** ..... **Fort Peck No. 3**
  14'x16' ..... 1508' Month
- **Utah Construction Co.** ..... **W. Iron Mountain**
  20'x20' ..... 1627' Month
- **L. A. Dept., Water & Power** ..... **Mono Basin**
  12'x12' ..... 1219' Month
- **Walsh Construction Co.** ..... **Whipple Mountain**
  19'x19' ..... 1084' Month
- **Metropolitan Water Dist.** ..... **Coachella**
  19'x19' ..... 942' Month
- **Dixon-Bent & Johnson** ..... **Pasadena**
  12' Circ. ..... 2185' Month

ST. LOUIS POWER SHOVEL CO.
Douglas C. Corner, President May E. W. Corner, Secretary
324 E. Third St., Los Angeles, Cal'fornia
322 Clark Avenue, St. Louis, Missouri

†Federal Government.

Public Buildings (Continued)

Mass., Westwood—Town, W. H. Spokesfield, chn. School Com., 127 Washington St., voted not to build Junior and Senior High School. $150,000. E. S. Dodge & J. H. Child, 148 State St., Boston, archts. Noted Jan. 16, C. D. —Jan. 24, E. N.-R.

†**Mass., Whitinsville**—Treas. Dpt. at office Sup. Archt., Wash., D. C., plans constructing 1 story, brick, stone post office, Church and Cross Sts. Site selected.

Mich., Battle Creek—Bd. Educ. plans by A. B. Chanel, Battle Creek, 2 story, basement, brick, steel, stone, concrete library, plain found. Willard Library site. $105,000. P.W.A. project.

Minn., St. Paul—City, I. C. Pearce, comr. Educ., City Hall, plans by C. A. Bassford, city archt., City Hall, rebuilding 2 story basement, brick, cut stone, steel school, 747 Jenks St. $300,000. P.W.A. project.

Mo., Nevada—State Hospital 3, Nevada, and Bi-Partisan Advisory Bd, State Building Comn., E. M. Eagan, executive secy., Jefferson City, plans by M. Boulicault, Ambassador Bldg., and G. F. A. Brueggeman, 506 Olive St., St. Louis, $340,000; plans by Keene & Simpson, Land Bank Bldg., Kansas City, Mo., patients' cafeteria building $170,000•••plans by E. Hawkins, McDaniel Bldg., Springfield, reconstructing wards and roofs. $76,900. P.W.A. project.

N. H., Durham—School Dist. of Durham, G. Eastman, chn. School Bd., Newsmith Hall, rejected bids Dec. 17, 2 story, basement, 80x 117 ft. grade school, Garrison Ave. $114,318. Will refigure. Wells, Hudson & Granger, Main St., Hanover archts. Noted Dec. 17, C. D.

N. Y., Johnson City—Union Free School Dist. Bd. Educ., bids in spring, constructing school, Roberts St. $285,000. W. H. Whitlock, Binghamton, archt. Noted Oct. 31, C. D.—Nov. 7, E. N.-R.

N. Y., Kenmore — Town, bids in February, brick, steel municipal building, plain found., Delaware Ave. $200,000. Applied for P.W.A. funds. E. B. Greene, 1 Niagara Sq., Buffalo, archt. Noted Aug. 22, C. D.—Aug. 29, E. N.-R.

N. Y., Port Byron—Bd. Educ. plans rebuilding school, destroyed by fire. $250,000. Architect and engineer not appointed.

†**O., Dayton** — Vet. Bu., Arlington Bldg., Wash., D. C., rejected bids altering and constructing additions to Administration Building A. Noted Dec. 17, C. D.—Nov. 21, E. N.-R.

†**O., Willoughby**—Treas. Dpt. at office Sup. Archt., Wash., D. C., withdrew from market bids to have been taken Dec. 30, for constructing U. S. Post Office.

★ **Pa., Edinboro** — State, Edinboro Teachers College, Dr. Carmon Ross, pres., cancelled plans for constructing new buildings. $620,000. State Supreme Court invalidated State Authority Act providing funds for project. Meyers & Johnson, Erie, archts. Noted May 17, C. D.— May 23, E. N.-R.

Pa., Lititz—Lititz School Bd., High School Bldg., plans by H. Y. Shaub, 20 North Queen St., Lancaster high school. $150,000.

R. I., Howard (Cranston)—State, State House, Providence, rejected bids Dec. 17, 2 story, basement, 32x70 ft. canning building at State Hospital. Will readvertise. P.W.A. project. C. H. Lockwood, 171 Westminster St., Providence, archt.

Wash., Pullman — Washington State College plans by F. S. Smith, Pullman, 4 story, dormitory. $325,000.

Wash., Tacoma—O. Olson, dir. Dpt. Finance, Budget & Business, Olympia, rejected bids Dec. 11, constructing 1 and 2 story recreation hall and chapel at hospital grounds. $115,000. Noted Nov. 22, C. D.—Nov. 28, E. N.-R.

Wis., West Milwaukee—School Dist. 12, revised plans by Ebling & Plunkett, 739 Bway., Milwaukee, 2 story, 144x162 ft. school, West Greenfield Ave. $242,000. P.W.A. project. Bids Dec. 27, rejected. Noted Jan. 6, C. D.

BIDS ASKED

†**Ala., Jasper**—See "Contracts Awarded."

Calif., Camarillo—Jan. 28, by State, Dpt. P. Wks., Sacramento, 1 story, rein.-con. laundry in connection with state hospital plant, equipment not included. G. B. McDougall, state archt., P. Wks. Bldg., Sacramento, archt.

†**Conn., Thompsonville** — Jan. 31 (extended date), by Treas. Dpt. at office Sup. Archt., Wash., D. C., constructing U. S. Post Office. Noted Jan. 3, C. D.—Jan. 9, E. N.-R.

Idaho, Boise—Jan. 24, by City Comrs., Boise, general contract constructing high school, 13th and Fort Sts. $300,000. P.W.A. project. Tourtallotte & Hummel, Boise, archts. Noted Dec. 16, C. D.—Dec. 19, E. N.-R.

Ill., Chicago—Jan. 21, by Bd. Educ., constructing 3 story, basement, 112x117 ft. addition to Emmet Elementary School, 5500 West Madison St., $270,000; and 71x78 ft. addition to Kilmer Elementary School, North Shore and Greenview Ave. $150,000, both brick, plain found. J. C. Christensen, 228 South LaSalle St., archt.

†**Ill., Galesburg**—Feb. 21, by Treas. Dpt. at office Sup. Archt., Wash., D. C., constructing U. S. Post Office.

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Ill., Springfield—Jan. 24, by Bd. Educ., L. Burtle, secy., plans constructing McLernand School. P.W.A. project. S. J. Hanes & Son, 205 1/3 South 6th St., archts.

†**Ia., Waverly**—Jan. 27, by Treas. Dpt. at office Sup. Archt., Wash., D. C., constructing U. S. Post Office. $68,000. Noted Dec. 5, C. D.—Dec. 12, E. N.-R.

†**Ky., Carrollton**—Feb. 18, by Treas. Dpt. at office Sup. Archt., Wash., D. C., extending and remodeling U. S. Post Office. $50,000.

Me., Augusta—Feb. 4 (extended date), by State Dpt. Health & Welfare, State House, 3 story, basement, 72x320 ft. dormitory, incl. heating, plumbing, electrical work, at State Hospital. $350,000. P.W.A. project. J. Calvin & J. H. Stevens, 187 Middle St., Portland, archts. Noted Dec. 19, C. D.—Dec. 26, E. N.-R.

†**Mass., Bourne**—Jan. 23, by U. S. Coast Guard, Wash., D. C., constructing dwelling and garage, at Cape Cod Canal, Coast Guard Station.

Mass., Waltham—Jan. 23, by Comrs. Middlesex Co., W. C. Wardwell, chn. Court House, East Cambridge, 3 story, basement, brick, ward building, surgical wing and dining room, concrete found., at County Hospital. To exceed $150,000. P.W.A. project. Jas. H. Ritchie & Associates, 100 Arlington St., Boston, archts.

Mo., Jefferson City—Jan. 30, by State Building Comn., Bi-Partisan Advisory Bd., R. N. Howell, secy., Capitol, Jefferson City, furnishing, installing boilers and stokers in power plants of State Hospital 1, at Fulton, State Hospital 3, at Nevada and Missouri State School at Marshall.

★ **Mo., St. Louis**—Feb. 4, by Bd. P. Service, City Hall, removing existing structures, guard fence, 16,000 cu.yd. general excav., 7,000 ft. foundation excav. and 2,700 cu.yd. foundation concrete for 2 story, basement, rein.-con., brick, stone, steel armory, Camp Jackson Blvd. between Pine St. and Lawton Ave. $17,500. P.W.A. project. Total est. $1,238,000. A. Osburg, city archt. W. E. C. Becker, city engr.

†**Mont., Blackfoot**—Feb. 6, by Dpt. Interior, Purchasing Office, Wash., D. C., constructing hospital building, nurses' quarters, 2 doctors' houses and 2 garages.

†**Mont., Crow Agency**—Feb. 6, by Dpt. Interior, Purchasing Office, Wash., D. C., constructing hospital building, 2 doctors' houses and nurses' quarters.

★ †**Mont., Missoula**—Feb. 24, by Treas. Dpt. at office Sup. Archt., Wash. D. C., constructing U. S. Post Office and Court House annex. $600,000.

N. Y., Albion—Feb. 20, by State Dpt. Correction, State Office Bldg., Albany, miscellaneous construction work at Albion State Hospital.

N. Y., Brooklyn—Jan. 21 (extended date), by W. C. Martin, archt. and Supt. School Buildings, Flatbush Ave. extension and Concord St., Brooklyn, constructing P.S. 234, East 17th St. and Avenue S, for Bd. Educ., 500 Park Ave., New York. Noted Dec. 3, C. D. — Jan. 2 E. N.-R.

N. Y., Clarence—Jan. 20, by Bd. Educ., W. J. Schutt, pres., School Bldg., general contract plumbing, heating, drainage, electrical work and ventilating for school addition, for Union Free School Dist. 1, Clarence, Newstead and Lancaster, Erie Co., Albert Hart Hopkins, 2102 Liberty Bank Bldg., Buffalo, archt. P.W.A. project.

★ **N. Y., Marcellus**—Union Free School Dist. 2, bids about Feb. 1, constructing superstructure for school. Total est. $530,000. P.W.A. project. C. W. Clark, 27 North Main St., Cortlandt, archt. Noted Oct. 24, C. D.— Oct. 31, E. N.-R.

N. Y., Sonyea—Feb. 26, by Dpt. Mental Hygiene, State Office Bldg., Albany, miscellaneous construction work at Craig Colony (Hospital). W. E. Haugaard, State Office Bldg., Albany, archt.

†**N. C., Cherokee**—Feb. 7, by Dpt. Interior, Purchasing Office, Wash., D. C., constructing hospital building and part basement, here.

Ore., Mapleton—Jan. 28, by Directors School Dist. 32, Lane Co., constructing 1 story, basement school, $201,000. P.W.A. project. Barrett & Logan, 302 North Bway., Portland, archts.

†**R. I., Wakefield**—Jan. 30 (extended date), by Treas. Dpt. at office Sup. Archt., Wash., D. C., constructing U. S. Post Office. Noted Dec. 27, C. D.—Jan. 2, E. N.-R.

†**Tenn., Nashville**—Jan. 29 (extended date), by Treas. Dpt. at office Sup. Archt., Wash., D. C., remodeling (except elevators), U. S. Post Office. Noted Dec. 17, C. D.—Dec. 26, E. N.-R.

†**Tex., Bayton**—Jan. 29 (extended date), by Treas. Dpt. at office Sup. Archt., Wash., D. C., constructing U. S. Post Office. Noted Dec. 18, C. D.—Dec. 26, E. N.-R.

★ †**Tex., Dallas**—Jan. 31, by Treas. Dpt. at office Sup. Archt., Wash., D. C., constructing U. S. Post Office (except elevator). $700,000.

Tex., Wichita Falls—Wichita Falls Jr. College Dist., c/o C. H. Clark, pres., taking bids superstructure for 2 story, brick, rein.-con. public school, plain found. $350,000 complete. P.W.A. project. Voelcker & Dixon, Inc., 913½ Indiana Ave., archts. Noted Nov. 15, C. D.—Nov. 21, E. N.-R.

†**Va., Roanoke**—Feb. 11, by Vet. Bu., Arlington Bldg., Wash., D. C., constructing Infirmary Building 12 and nurses' quarters addition.

★ **Wash., Olympia**—Feb. 5, by State Capitol Com., State Hy. Bldg., 4 story, basement office building. $922,000. J. H. Wohleb, Chambers Bldg., archt. Noted Oct. 4, C. D.— Oct. 10, E. N.-R.

Wis., Wauwatosa — Jan. 21, by Milwaukee Co. Institutions, constructing 1 story, 60x81 ft., brick, rein.-con. boiler house, plain found. for county institutions. P.W.A. project. J. Messmer, c/o owner, archt. Noted Jan. 7, C. D. —Jan. 9, E. N.-R.

Wis., West Milwaukee—Jan. 21, by School Dist. 2, S. Merdrum, 118 South 50th St., constructing and altering 2 story, 144x162 ft. high school. $242,000. P.W.A. project. Former bids rejected. Plunkett & Ebling, 739 North Bway., Milwaukee, archts. Noted Oct. 14, C. D. —Oct 17, E. N.-R.

†**Wyo., Yellowstone Park**—Feb. 5 (extended date), by Treas. Dpt. at office Sup. Archt., Wash., D. C., constructing U. S. Post Office. Noted Jan. 3, C. D.—Jan. 9, E. N.-R.

CONTRACTS AWARDED

†**Ala., Jasper**—U. S. Resettlement Administration, Construction Div., Liberty Life Bldg., Birmingham, constructing seventy-six 1 story, frame houses, day labor.

★ **Ariz., Tucson**—University of Arizona, Bd. Regents, constructing science building, auditorium, administration building, infirmary and R.O.T.C. stables, to M. M. Sundt Constr. Co., 629 North Olsen St. $553,434. P.W.A. Awarded Jan. 3. Noted Oct. 25, C. D.—Oct. 31, E. N.-R.

Conn., East Hartford (br. Hartford)—G. Cudemo, Inc., general contractors, 983 Main St., Hartford, excavating in connection with construction of town hall, to E. B. Mcgurk, Inc., 1300 Albany Ave., Hartford, for Town Bd., Selectmen•••steel cells, to Van Dorn Iron Wks., 2685 East 79th St., Cleveland, O.••• sanitary work, to Beradini Silvestri, 21 Mapleton St., Hartford•••reinforcing steel, to Scherer Steel Co., Inc., 151 Ballard Dr., West Hartford •••heating, plumbing and ventilating, to Byrnes Millward Co., 26 High St., Hartford••• structural steel, ornamental iron, to Standard Structural Steel Co., 101 Wethersfield Ave., Hartford•••brownstone, to Kelly Bros., 93 Charter Oak Ave., Hartford. Noted Dec. 13, C. D.—Dec. 19, E. N.-R., under "Contracts Awarded."

Conn., Guilford—Town, S. Spencer, chn. Building Comn., 2 story, basement, 60x155 ft. and 50x70 ft., brick, steel high school, to E. and F. Constr. Co., 94 Wells St., Bridgeport. $145,236. P.W.A. Noted Dec. 19, C. D.— Dec. 5, E. N.-R.

Conn., Stratford—Edward E. Bray Co., general contractors, 362 River St., Bridgeport, structural steel in connection with construction of brick town hall, to Topper & Griggs, 200 North Main St., West Hartford, for Town, at office of W. H. Shea, town mgr.•••reinforcing steel, to Truscon Steel Co., 42 Church St., New Haven•••electrical work, to W. T. Koch, Hughes Ave., Bridgeport•••heating and plumbing, to Schitinger & Ladwig, Inc., 43 Berkshire Ave., Bridgeport. Noted Dec. 17, C. D.— Dec. 26, E. N.-R., under "Contracts Awarded."

Conn., West Hartford (br. Hartford)—Industrial Constr. Co., general contractors, 721 Main St., Hartford, awarded sub-contracts for excavating in connection with construction of 2 story, 65x200 ft. and two 64 ft. wings town hall, to R. H. Cone, 85 Lancaster Rd., for Town, R. L. Loomis, mgr.•••limestone, to Ingalls Stone Co., Bedford, Ind.•••electrical work, to Bauer & Co., Inc., 440 Asylum St., Hartford•••plumbing, to J. Lyon & Sons, 20 Central Row, Hartford•••structural steel, to Lehigh Structural Steel Co., Allentown, Pa. Noted Dec. 17, C. D.—Dec. 26, E. N.-R., under "Contracts Awarded."

D. C., Wash.—District Comrs., District Bldg., constructing Elliott Junior High School addition, to Northeastern Constr. Co., 6 West Madison St., Baltimore, Md., $150,660. Bids Dec. 23, C. D.—Dec. 19, E. N.-R.

†**Fla., St. Augustine**—Treas. Dpt. at office Sup. Archt., Wash., D. C., 1 freight elevator in U. S. Post Office, to Otis Elevator Co., 810 18th St. N. W., Wash., D. C., $3,209.

Ill., Springfield—Bd. Educ., L. Burtle, secy., constructing Lanphier Park High School, North Grand and 10th Sts., to Alzina Constr. Co., Illinois Bldg., $243,000. P.W.A. Bids Dec. 27, awarded Jan. 2. Noted Dec. 27, C. D.— Dec. 19, E. N.-R.

Kan., Arkansas City—Bd. Educ., constructing 1 story, basement, 130x170 ft., brick, rein.-con. gymnasium and auditorium, plain found., to M. J. Green, Manhattan, $183,000. P.W.A. Noted Nov. 27, C. D.—Dec. 5, E. N.-R.

Kan., Dighton—Bd. Educ., 3 story, basement, brick, steel, stone high school, to Foy Constr. Co., Hutchinson, $167,920. G. H. Thomas, Wichita, archt.

Kan., Hoisington—City, brick, steel power plant and distribution system, 3 Diesel engines, to Chapin Constr. Co., 243 South Crestway St., Wichita, $135,000. Noted Dec. 16, C. D.— Dec. 19, E. N.-R.

†*Federal Government.*

Public Buildings (Continued)

Me., Mexico—C. E. Burton, gneeral contractor, 206 Coyle St., Portland, awarded separate contracts for painting, in connection with construction of high school, to F. H. Volanth, 87 North St., Milford, Conn., for Town, J. J. Johnson, clk.***structural steel and iron, to Lyons Iron Wks., Inc., 500 Willow St., Manchester, N. H.***reinforcing steel, to Concrete Steel Co., 294 Washington St., Boston, Mass. P.W.A. Noted Oct. 29, C. D.—Oct. 31, E. N.-R.

†**Md., Chestertown**—Treas. Dpt. at office Sup. Archt., Wash., D. C., constructing 1 story, basement, post office, to H. J. Geyer, 1009 Beechfield Ave., Baltimore, $65,138.

Mass., Abington—Town, D. D. Wyman, chn. Building Comn., Town Hall, 2 story, basement, 66x126 ft., and 64x175 ft., brick, steel, stone, granite high school, to Parkman Realty Co., 27 School St., Boston, $224,395. **P.W.A.** Bids Nov. 26, awarded Jan. 2. Noted Dec. 6, C. D.—Nov. 21, E. N.-R.

Mass., Boston—City, Bd. Public Welfare, 43 Hawkins St., general contract, incl. heating, plumbing, electrical work, 3 story, basement, 39x72 ft. public welfare building, Hancock St., Dorchester, to R. J. Connolly, Inc., 1146 Dorchester Ave., Dorchester, $56,944; 3 story, basement, 39x72 ft. public welfare building, Maverick and Bremen Sts., East Boston, to P. J. Cantwell & Son, 644 East Fourth St., South Boston, $58,448. **P.W.A.** Bids Nov. 27, awarded Dec. 20. Noted Dec. 9, C. D.—Oct. 31, E. N.-R.

Mass., Boston—Daniel Cunningham Constr. Co., Inc., general contractors, 513 Statler Bldg., Boston, awarded sub-contracts for excavation in connection with construction of power house addition at City Hospital, to John P. Cavanagh Co., 25 Medway St., Mattapan, for City, Trustees of Boston City Hospital, 818 Harrison Ave. ***reinforcing steel, to Truscon Steel Co., 38 Chauncy St.***structural steel and iron, to Globe Iron Wks., 17 Middlesex St., Charlestown ***heating, to J. J. Hurley & Co., 104 Bway. ***plumbing, to C. H. Cronin, Inc., 14 Bryon St.***painting, to M. L. McDonald Co., 365 Albany St.***caissons, to Thos. Cavanaugh, Inc., 46 Cornhill. Noted Nov. 22, C. D.—Nov. 28, E. N.-R.

Mass., Boston — Daniel Cunningham Constr. Co., general contractors, 513 Statler Bldg., Boston, awarded sub-contracts for demolition in connection with construction of Quincy Market addition, Market St., for City, R. O. Hall, supt. Buildings, 1005 City Hall Annex, to New England Building Wrecking Co., 23 3rd St., Chelsea***structural steel, to Bethlehem Fabricating Fabricators, Inc., Bethlehem, Pa.***shoring, to John Cavanagh & Son Building Moving Co., 473 Dorchester Ave., South Boston***steel erection, to Daniel Marr & Son Co., 384 Dorchester Ave., South Boston***light iron, to Globe Iron Wks., 17 Middlesex St., Charlestown***painting, to H. Newton Marshall Co., 522 Harrison Ave.***refrigerator insulation work, to United Cork Companies, 716 Columbus Ave., Roxbury***refrigeration brine piping, to Walworth English Flett Co., 81 Commercial Wharf***brine supplies, to Quincy Market Cold Storage & Warehouse Co., 178 Atlantic Ave.***overhead meat rail system, to Worcester Tram Rail Co., Inc., 10 T Wharf ***heating, to J. J. Hurley & Co., 104 Broadway***plumbing, to P. W. Donaghue Co., 342 Newbury St.***electrical work, to James Wilkinson & Co., 128 Oliver St.***reinforcing steel and metal pans, to Grid Flat Slab Corp., 761 Dudley St., Roxbury. **P.W.A.** Noted Jan. 2, C. D.—Jan. 9, E. N.-R., under "Contracts Awarded."

Mass., Boston—Carilli Constr. Co., general contractors, 7 Water St., Boston, awarded subcontracts for heating, in connection with construction of Robert Gould Shaw School, to B. B. Crocker & Co., 107 Mass. Ave., for City, Dpt. School Buildings, W. W. Drummey, supt. of Construction, 11 Beacon St.***plumbing, to Downey Co., 791 Tremont St.***electrical work, to Carroll Electric Co., 19 West 3rd St., South Boston***structural steel, to Bethlehem Fabricators, Inc., Bethlehem, Pa. ***light iron, to Progressive Iron Wks., Inc., 150 4th St., Chelsea***painting, to R. Tweed & Son, 45 Dudley St., Roxbury***marble, tile and terrazzo, to Freeport Marble & Tile Co., 264 Adams St., Dorchester***cast stone, to Cambridge Cement Stone Co., 156 Lincoln St., Brighton***steel erection, to E. C. Magown, 320 Park Ave., Arlington. **P.W.A.** Noted Dec. 11, C. D.—Dec. 19, E. N.-R., under "Contracts Awarded."

Mass., Boston—Ruzo Constr. Co., Inc., general contractors, 80 Boylston St., Boston, awarded sub-contracts for structural steel, in connection with construction of intermediate school, Phillips Brooks Dist., Dorchester, to A. O. Wilson Structural Co., 38 Chauncy St., for City, Dpt. School Buildings, 11 Beacon St. ***painting, to Albert D. Howlett Co., 110 Worcester St.***heating and ventilating, to M. J. Flaherty Co., 342 Newbury St.***electric and gas, to M. B. Foster Electric Co., 368 Congress St.***reinforcing steel, to Concrete Steel Co., 294 Wash. St. **P.W.A.** Noted Dec. 18, C. D.—Dec. 26, E. N.-R.

Mass., Boston—Thomas O'Connor & Co., 238 Main St., Cambridge, excavation in connection with construction of 3 story, basement, 200x257 ft., intermediate school, Eliot Square, Dudley Dist., Roxbury, to Marrinucci Bros. & Co., 51 Ceylon St., Dorchester (Boston), for City of Boston, Dpt. School Buildings, 11 Beacon St. Noted Jan. 2, C. D.—Jan. 9, E. N.-R., under "Contracts Awarded."

†*Federal Government.*

Mass., Braintree—H. Cunningham & Co., general contractors, 31 Exchange St., Lynn, awarded separate contracts for structural steel, for nurses' home, to West End Iron Wks., 263 Columbia St., Cambridge, for Comrs. Norfolk Co., Court House, Dedham***painting, to Johnson, Foster Co., 69 Meacham Rd., Somerville ***structural and reinforcing steel erection, to E. C. Magoun, 320 Park Ave., Arlington. Noted Dec. 17, C. D.—Dec. 26, E. N.-R., under "Contracts Awarded."

Mass., Concord—I. P. Rocheford, general contractor, 8 Arlington Pl., Framingham, awarded sub-contract for structural steel in connection with construction of gymnasium building, Stow St., for Town, Bd. Selectmen, W. H. Brown, chn. Building Comn., Town Hall, to New England Structural Co., 310 Second St., Everett ***iron, to James A. Glass Co., Inc., 214 High St., Boston***stone, to Alexander Thomson, Inc., 36 Albany St., Cambridge***painting, to O. P. Blomquist Co., 289 Congress St., Boston. Noted Dec. 27, C. D.—Jan. 2, E. N.-R.

Mass., Danvers—B. L. Moore, general contractor, 43 Maple St., Framingham, awarded sub-contracts for electrical work, for building work (power plant), Contr., A. at Danvers State Hospital, to Friedman Electric Co., 137 Pearl St., Boston***structural steel and light iron, to Eastern Bridge & Structure Co., Worcester***painting, to H. Newton Marshall Co., 522 Harrison Ave., Boston***Acme Heating & Ventilating Co., 13 Hawkins St., Boston, general contractor on Contr. B, boilers, boiler settings and oil burner installation, awarded subcontracts for boilers, to International Eng. Wks., Framingham***boiler settings, to D. L. MacFarlane, 11 Beacon St.***Underground Steam Constr. Co., 75 Pitts St., Boston, general contractor for Contr. C, steam piping, awarded sub-contracts for structural steel, to Waghorne-Browne Co., 44 School St., Boston***pipe insulation, to Philip Carey Co., 121 Beverly St., Boston. **P.W.A.** Noted Dec. 20, C. D.—Dec. 26, E. N.-R., under "Contracts Awarded."

Mass., Fitchburg—Turner Constr. Co., general contractors, 143 Newbury St., Boston, awarded contract for 700 tons structural steel in connection with construction of high school, to Boston Bridge Wks., Binney St., Boston, for Bd. Educ., A. F. Pelletier, supt. of Buildings. Noted Dec. 17, C. D.—Dec. 26, E. N.-R., under "Contracts Awarded."

Mass., Monroe — Thos. J. Gass Co., general contractors, 79 Davis St., Greenfield, heating and plumbing for 2 story school, with town offices, to J. B. Kennedy, Newton Place, Greenfield, for Town, H. L. Meller, chn. Bd. Selectmen, Town Hall***structural steel, to Haarman Steel Co., Ducharme Ext., Holyoke***reinforcing steel, to Truscon Steel Co., 38 Chauncy St., Boston***excavating, to A. J. Maximillian, North Adams***electrical work, to Streeter Electric, Inc., Main St., Greenfield. **P.W.A.** Noted Dec. 31, C. D.—Jan. 9, E. N.-R.-R., under "Contracts Awarded."

Mass., Montague—Town, W. P. Argy, chn. Building Comn., Montague Town Hall, in Turners Falls, 2 story, basement, 57x79 ft. and 2 story, basement, 89x204 ft. high school addition and gymnasium, incl. heating, plumbing, electrical work, Crocker Ave., to Geo. H. Reed & Co., Inc., 24 Franklin St., Greenfield, $159,221. **P.W.A.** Bids Nov. 22, awarded Dec. 24. Noted Dec. 6, C. D.—Aug. 29, E. N.-R.

Mass., Orange—Geo. H. Reed & Co., general contractors, 24 Franklin St., Greenfield, heating and plumbing for fire station, to J. B. Kennedy, Newton Place, Greenfield, for Town, G. Stevens, chn. Bd. Selectmen, Town Hall*** electrical work, to A. C. Senecal Co., Box 35, Westboro***roofing, to Columbia Cornice Co., 268 Elm St., Cambridge***building finish, to Ely Lumber Co., 13 Cabot St., Holyoke*** reinforcing steel, to Truscon Steel Co., 38 Chauncy St., Boston. **P.W.A.** Noted Dec. 31, C. D.—Jan. 9, E. N.-R., under "Contracts Awarded."

Mass., Plymouth — Town, E. H. Donovan, chn. School Com., Town Hall, 2 story, basement, 48x173 ft. and 90x120 ft. and 26x82 ft. ells, new high school and additions to present Junior High School, to D'Amore Constr. Co., 89 State St., Boston, $302,000. **P.W.A.** Bids Dec. 9, awarded Dec. 24. Noted Dec. 18, C. D.—Dec. 5, E. N.-R.

Mass., Southbridge—F. X. Laliberte & Son, Inc., general contractors, 59 Beecher St., Southbridge, cast stone for Eastford Rd. Elementary School, to Emerson & Novis Co., 163 North Beacon St., Brighton, for Town, School Dpt., E. A. Schumacher, chn. Building Comn.*** structural steel, to Stafford Iron Wks., Inc., 135 Stafford St., Worcester***painting, to Priscilla Paint & Roofing Shoppe, Inc., 266 Main St.***heating, ventilating and plumbing, to Thermostatic Control, G. C. Winter Co., 344 Main St., Southbridge***electrical work, to Alfred C. Senecal Electric Co., Box 35, Westboro. Noted Jan. 6, C. D.—Jan. 9, E. N.-R., under "Contracts Awarded."

Mass., Spencer—Town, C. N. Prouty, chn. Building Comn., Town Hall, altering and constructing 2 story, basement, 92x139 ft., high school addition, incl. heating, plumbing, electrical work, Main St., to J. W. Bishop Co., 109 Foster St., Worcester, $167,900. **P.W.A.** Bids Dec. 9, awarded Jan. 6. Noted Dec. 18, C. D.—Oct. 17, E. N.-R.

Mass., Swampscott—M. Spinelli & Sons, general contractors, 38 Chauncy St., Boston, plumbing for high school addition, to R. T. Pender, Inc., 33 Sutton St., Lynn, for Town, School Building Comn.***heating, to T. J. Murphy & Co., 8 Walden St., Cambridge***light iron, to Brayton-Wilson-Cole Corp., 130 Magazine St., Roxbury***structural steel, to West End Iron Wks., 263 Columbia St., Cambridge. Noted Jan. 2, C. D.—Jan. 9, E. N.-R., under "Contracts Awarded."

Mass., Tewksbury—Commonwealth of Massachusetts, Dpt. P. Welfare, Trustees State Infirmary, roadway and drainage system at storehouse and kitchen building unit, to J. J. Callahan, 119 Park St., West Roxbury, $4,500. **P.W.A.** Bids Dec. 10, awarded Jan. 7.

Mass., Tewksbury—Commonwealth of Massachusetts, Dpt. P. Welfare, State House, Boston, changes in plumbing, steam and water piping and sprinklers in kitchen and dining building at State Infirmary, part of P.W.A. Project C-1 Docket 5772, to Jas. S. Cassedy, Inc., 133 Austin St., 16,187***metal equipment in storehouse, part of P.W.A. project C-6, Docket 5751, to Berger Mfg. Co. of Mass., 307 Dorchester Ave., South Boston, $1,870. **P.W.A.** Noted Dec. 19, C. D.—Dec. 5, E. N.-R.

†**Mass., Wakefield**—Long Constr. Co., general contractors, 185 Devonshire St., Boston, reinforcing steel, for U. S. Post Office, for Treas. Dpt. at office Sup. Archt., Wash., D. C., to Truscon Steel Co., 38 Chauncy St., Boston; limestone, to Ingalls Stone Co., 11 Beacon St., Boston. Noted Jan. 3, C. D.—Jan. 9, E. N.-R.

Mass., Waltham—J. W. Duff & Sons, Inc., general contractors, 146 Summer St., Boston, awarded sub-contracts heating in connection with construction of Senior High School addition, to V. J. Kenneally Co., 251 Causeway St., Boston, for City, supt. Schools, Senior High School Bldg., School St.***plumbing, to Henry J. Lyons Co., 39 Melrose St., Boston***electrical work, to MacFarlane & Abbott Co., 46 Cornhill, Boston***painting, to C. F. Daniels Co., 99 Pacific St., Cambridge***marble, to Vermont Marble Co., 44 School St., Boston*** limestone and granite, to Alex Thomson, Inc., 36 Albany St., Cambridge***structural steel, to Grossier & Shlazer Iron Wks., 84 Washington St., Somerville***iron, to Quincy Ornamental Iron Wks., 161 A St., South Boston ***tile and terrazzo, to Zani Tile & Terrazzo Co., 191 Williams St., Chelsea. Noted Dec. 18, C. D.

Mass., Waltham — Commonwealth of Massachusetts, Comrs. Middlesex Co., W. C. Wardwell, chn. Building Comn., Court House, Cambridge, 2 story, basement, 41x116 ft. male employees dormitory and 2 story, basement, 32x73 ft. addition to nurses home, incl. plumbing, heating, electrical work, at County Hospital on Town line, to John Bowen Co., Inc., 124 Newbury St., Boston, $158,800. P.W.A. Bids Dec. 13, C. D., awarded Jan. 3. Noted Dec. 19, C. D.

Mass., Waverly — Matthew Cummings Co., general contractors, 43 Tremont St., Boston, awarded sub-contracts for structural steel in connection construction of administration building at State School, for Commonwealth of Massachusetts, Dpt. Mental Diseases, State House, Boston, to New England Structural Co., 310 Second St., Everett***painting, to O. P. Blomquist, 289 Congress St., Boston***reinforcing steel, to Concrete Steel Co., 294 Wash. St., Boston***erection of reinforcing steel, to A. Lavelli, 37 Spring St., Somerville***plumbing, to Wm. N. McKenna Co., 79 Chestnut St., Boston***electrical work, to James Wilkinson & Co., 128 Oliver St., Boston. Noted Jan. 2, C. D.—Jan. 9, E. N.-R., under "Contracts Awarded."

Mass., Westfield—L. D. Phillips Constr. Co., Inc., general contractors, 10 Main St., structural steel, miscellaneous iron and bronze for additions and alteration to boiler house and laundry at State Sanatorium, to Haarmann Steel Co., Ducharme Ext. West Holyoke***painting, to H. L. Ross Co., Inc., 7 Market St., Springfield ***reinforcing steel, to Kalman Steel Co., 75 Federal St., Boston. Noted Jan. 8, C. D.—Jan. 16, E. N.-R., under "Contracts Awarded."

Mass., Worcester—City, at office of Mayor, City Hall, smoke breeching in connection construction work in ward and surgical building at City Hospital, to Stewart Boiler Wks., Albany St., for City, Superintendent Building, City Hall***sprinkler, to Viking Automatic Sprinkler Co., 430 Statler Bldg., Boston, $3,164 ***plumbing fixtures, to R. C. Sullivan Co., 265 6th St., Cambridge, $16,344. Grand total $21,108.

Mich., Saginaw — C. A. F. Dall, secy. Bd. Educ., 544 Millard St., for Junior High School, 2 story, brick, steel, rein.-con., plain found., to Spence Bros., Saginaw, $67,400***heating and ventilating, to Hansen-Snyder Co., Saginaw, $12,500***plumbing, to O. Carlson, Saginaw, $1,100. Grand total $71,000. **P.W.A.** Bids Nov. 19. Noted Nov. 8, C. D.—Nov. 14, E. N.-R.

Mich., Trenton—Bd. Educ., general contract brick, steel, rein.-con. school, plain found., to Cooper Little Co., 844 Maccabees Bldg., Detroit, $105,400; plumbing, to Page Heating & Plumbing Co., River Rouge, $25,690. **P.W.A.** Bids Dec. 4. Noted Dec. 20, C. D.

Minn., Minneapolis — Bd. Educ., City Hall, excavation for 2 story, basement, rein.-con., brick, stone school, 50th and Dupont Aves. N., to C. H. Peterson & Co., 5749 Pillsbury Ave., $2,985. Total est. $200,000. **P.W.A.** Bids on superstructure later. Noted Dec. 16, C. D.

Minn., Rochester—City Public Utility, A. J. Lentger, secy., City Hall, furnishing, installing steam boiler and accessories in power plant, boiler unit, to Commonwealth Electric Co., 417 Bway., St. Paul, $126,365; stoker, to A. R. Robertson Co., 1603 University Ave., $35,397. Bids Dec. 13.

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Public Buildings (Continued)

★ **Mo., Columbia**—University of Missouri, 4 story, basement, 43x116 ft. health building and 3 story, 139x257 ft. educational building for University of Missouri, to Dickey Constr. Co., 317 North 11th St., St. Louis, $173,128 and $231,460 respectively***3 story, basement, 101x166 ft. library, to Kellerman Constr. Co., 625 North Euclid St., St. Louis, $311,000, all brick, rein.-con. Grand total $715,588. **P.W.A.** Bids Jan. 3. Noted Dec. 30, C. D.

Mo., Macon—Missouri State Hy. Dpt., Jefferson City, grading and sewer work for 1 and 2 story garage and division office, to Ebbe Constr. Co., Trenton, $1,707. **P.W.A.** Bids Dec. 14. Noted Sept. 12, C. D.—Sept. 19, E. N.-R.

Mo., Neosho—Newton Co., C. E. Jeffrey, clk., clearing and excavating site for 3 story, basement, 90x112 ft. court house, to J. M. Roark, Anderson, $2,850. **P.W.A.** Bids Dec. 7. Noted Dec. 3, C. D.

Mo., Ste. Genevieve—Rinehart Constr. Co., general contractors, 1010 Pine St., St. Louis, joist and reinforcing steel for 2 story, basement, brick, concrete school and auditorium, for School Dist., H. L. Pauler, secy., to Concrete Eng. Co., Louderman Bldg. ***mill work, to North St. Louis Planing Mill Co., 3616 Carter St.***slate blackboards and bulletin boards, to Standard Blackboard Co., 101 South 2nd St.***plaster board, to Parlock Appliers, Chemical Bldg.***caulking, to LeRoy Tent & Awning Co., 3438 South Grand St.***plumbing, to C. Moynihan & Son, 2007 Olive St., all foregoing in St. Louis***sheet metal work, to Silvers Sheet Metal Co., Caruthersville***painting, to Priest Bros. Painting Co., Poplar Bluff***electrical work, to United Electric Co., 815 Bway., Cape Girardeau***heating, to R. W. Vaught, Camdenton. **P.W.A.** Noted Nov. 22, C. D.—Nov. 28, E. N.-R.

Mo., St. Louis—Bd. P. Service, City Hall, general contract 1 story, basement, 53x68 ft., brick, rein.-con. police station and attached garage, Hampton Blvd. near Reber Pl., to M. P. Rosenmeyer, Inc., 4817 Oleatha St., $115,473. Est. $110,000. **P.W.A.** Bids Dec. 27. Noted Dec. 6, C. D.—Dec. 12, E. N.-R.

Mo., West Plains—Howell Co., clearing site and excavating for court house and jail, to L. H. Britton, Mountain Grove, $7,589. **P.W.A.** Bids Dec. 7. Noted Dec. 3, C. D.—Sept. 26, E. N.-R.

N. H., Concord—Swanbury Constr. Co., general contractors, 61 Amherst St., Manchester, awarded sub-contracts for structural steel and light iron work, for Tobey Building addition at state hospital, for State, E. H. Hunter, ch. engr. P. Wks. Division, State House, Concord, to F. P. Lyons Iron Wks., Inc., 500 Willow St., Manchester, $9,252 and $9,100 respectively***elevator, to Portland Elevator Co., Inc., 133 Oliver St., Boston, Mass., $5,120*** millwork, to J. Hodge Co., 485 Elm St., Manchester, $3,487***painting, to H. Newton Marshall Co., 522 Harrison Ave., Boston, Mass., $4,760. Grand total $31,669. Noted Jan. 2, C. D.—Jan. 9, E. N.-R., under "Contracts Awarded."

N. H., Laconia—W. M. Bisson, general contractor, 91 Church St., sublet sub-contracts for heating and plumbing in connection with construction of Practical Arts School, to J. J. Morin, 77 New Salem St., for City, J. S. Gilman, supt. Schools, High School***reinforcing steel, to J. T. Ryerson & Son, Inc., 3rd St., Cambridge, Mass.***structural steel, to Lyons Iron Wks., Inc., 500 Willow St., Manchester ***cast stone, to Emerson & Novis Co., 163 North Beacon St., Brighton, Mass.***painting, to J. T. Quay, Laconia***steel, erection, excavation, masonry, insulation and plaster by general contractor. **P.W.A.** Noted Dec. 17, C. D. —Dec. 26, E. N.-R., under "Contracts Awarded."

★ **N. J., Ramsey**—Bd. Educ., High School Bldg., constructing high school, to H. Montague & Son, 924 Bergen Ave., Jersey City, $328,596***plumbing, to Jachnig & Peoples, 223 3rd Ave., Newark, $27,067***structural steel, to Lehigh Structural Steel Co., Allentown, Pa., $39,895***electrical work, to Bedaracco & Co., 107 Bloomfield Ave., Newark, $25,290***heating and ventilating, to F. A. McBride, 325 Grand St., Paterson, $45,812. Grand total $466,660. **P.W.A.** Noted Jan. 7, C. D.—Jan. 9, E. N.-R.

N. J., Vineland—Dpt. Institutions & Agencies, Trenton, for deaerating heater, 75,000 lb. per hr. capacity for power house, Vineland State School, to Elliott Co., Morris Bldg., Phila., Pa., $3,717. Noted Dec. 16, C. D.

N. Y., Bath—Village, general contract constructing hospital, to F. Gleason Co., 108 Colvin St., Rochester***electrical work, to Louis Horack, 82 Norman Rd.***plumbing, to E. G. Snyder, Inc., 86 Scio St., Rochester***heating, to L. C. Greseus, 332 Hurstbourne St., Rochester. **P.W.A.** Bids were originally rejected due to cost exceeding appropriation, but funds have been raised by popular subscription. Noted Dec. 11, C. D.—Dec. 19, E. N.-R.

★ **N. Y., Brooklyn** — Bd. Educ., 500 Park Ave., New York, constructing P. S. 49, to John Kennedy & Co., Inc., 41 East 42nd St., New York, $1,058,000. **P.W.A.** Bids Dec. 3. Noted Nov. 4, C. D.—Dec. 12, E. N.-R.

★ **N. Y., Brooklyn** — Bd. Educ., 500 Park Ave., New York, plumbing for Franklin K. Lane High School, to J. EJ Kahn, 224 West 20th St., New York, $172,990***heating, to D. J. Rice, Inc., 41-20 38th St., Long Island City, $309,670***electrical work, to Arc Electrical Constr. Co., 739 2nd Ave., New York, $144,440***fixtures, to Simes Co., Inc., 22 West 15th St., New York, $34,762. Grand total $531,862. **P.W.A.** Bids Nov. 20. Noted Nov. 21, C. D.

†**N. Y., Buffalo**—Fleischer Eng. & Constr. Co., general contractors, Minnesota Bldg., St. Paul, Minn., rein.-con. arches and fireproofing structural steel, federal office building and court house, Franklin Court, for Treas. Dpt., Wash., D. C., to Knickerbocker Fireproofing Co., 56 West 45th St., New York; hollow tile, to Southern Fireproofing Co., 561 Reading Rd., Cincinnati, O. Noted Oct. 29, C. D.—Oct. 31, E. N.-R., under "Contracts Awarded."

N. Y., Carmel—Bd. Supervs. Putnam Co., County Bldg., plumbing for county office building, to Hauxwell & Smith, 44 Broad St., Port Chester***heating and ventilating, to T. G. Egan Refractory Eng. Co., 70 Kane St., Brooklyn***electrical work, to J. E. Barker, 76 Rossmore Ave., Bronxville. **P.W.A.** Noted Jan. 2, C. D.—Jan. 9, E. N.-R., under "Contracts Awarded."

N. Y., Corfu—Union Free School Dist. 7, excavation and foundations for school, to Delavan Constr. Corp., 85 Edison St., Buffalo. **P.W.A.** Former contract rescinded. Noted Dec. 2, C. D. —Dec. 5, E. N.-R., under "Contracts Awarded."

N. Y., Churchville—Bd. Educ. Union Free School Dist., excavating, grading and foundations for school, to Gorshine & Swan Constr. Co., 96 Pearl St., Rochester. **P.W.A.** Total est. $185,000. Bids Jan. 4, awarded Jan. 7. Noted Jan. 10, C. D.

†**N. Y., Goshen**—S. Plato, general contractor, 404 East Bway., Kokomo, Ind., electrical work for post office, Grand St., to A. W. Bitterman, 70 Partition St., Saugerties, for Treas. Dpt. at office Sup. Archt., Wash., D. C.; roofing, to Umland Bros., Inc., 858 Jefferson St., Buffalo. Contractor taking bids on painting and terrazzo floor finish. Noted Sept. 30, C. D.—Oct. 3, E. N.-R., under "Contracts Awarded."

N. Y., Hornell—Wright & Kremers, Inc., general contractors, Main St. and Pine Ave., structural steel for repairing State Infantry Armory, for Dpt. Military and Naval Affairs, Capitol Bldg., Albany, to Dobbie Fdry. & Machine Co., Portage Rd., Niagara Falls***tile and marble, to Queen City Marble Tile & Terrazzo Co., 2360 Baily Ave., Buffalo***millwork, to Wicker Lumber Co., Inc., 3403 Highland Ave., Niagara Falls. Noted Jan. 2, C. D.—Jan. 8, E. N.-R., under "Contracts Awarded."

N. Y., Rochester—Bd. Educ., masonry for School 4, to F. G. Maggio & Bros., 374 Augustine St., Rochester***carpentry, to F. Gleason Co., 108 Colvin St.***stone, to Goodstone Mfg. Co., 470 Hollenbeck St. **P.W.A.** Noted Jan. 7. C. D.—Jan. 9, E. N.-R., under "Contracts Awarded."

★ **N. Y., Rochester**—Bd. Supervs. Monroe Co., excavating, grading and erecting field office for county penitentiary, Henrietta Rd., to Rappl & Hoeniz, 2350 East Ridge Rd. **P.W.A.** Bids about Feb. 15, on superstructure. Total est. $1,000,000. C. A. Damuth, 311 Alexander St., archt. Noted Dec. 11, C. D.—Oct. 24, E. N.-R.

N. Y., Rome—City, constructing police and fire alarm signal plant equipment, to Gamewell Co., Newton, Mass. **P.W.A.** Former contract rescinded. Noted Dec. 19, C. D.—Dec. 26, E. N.-R., under "Contracts Awarded."

N. Y., Rotterdam—K. Varney, general contractor, 1719 Athol Rd., painting county highway building, Kellar Ave., for Bd. Supervs. Schenectady Co., to F. J. Kolb & Son, 728 Bedford Rd., Schenectady. Noted Oct. 7, C. D. —Oct. 10, E. N.-R., under "Contracts Awarded."

N. Y., Troy — Marinello & Stanco, general contractors, 6 Summit Ave., Albany, excavation and foundations for Lansingburgh School, 107th St., for Bd. Educ., to Dinova & Mende, 149 Hunter Ave., Albany; reinforcing steel, to Strope Steel Co., Inc., Terminal St., Albany. **P.W.A.** Noted Dec. 10, C. D.—Dec. 12, E. N.-R.

N. D., Grand Forks—Bd. Educ., W. P. Rognlie, secy., excavation and foundations for 4 story, brick, steel, stone school addition, to C. G. Steen Co., Grand Forks, $10,855. **P.W.A.** Soon takes bids on superstructure. Noted Dec. 2, C. D.—Dec. 5, E. N.-R.

O., Cleveland—City, 1 story, basement, 160x 208 ft., brick, steel garage on West 3rd St. and Mahoning Ave., to S. W. Emerson Co., 1836 Euclid Ave., $136,140. **P.W.A.** Noted Dec. 18, C. D.—Dec. 26, E. N.-R.

O., Pemberville—City, constructing new high school, to Clarence Knowlton, Bellefontaine, $114,475. **P.W.A.** Noted Nov. 21, C. D.—Nov. 28, E. N.-R.

O., Roseville — City, general contract constructing school, to W. A. Showers & Co., Crooksville, $91,839***plumbing, to Eastern Plumbing Co., 1235 Oak St., Columbus, $8,099 ***heating and ventilating, to Stanton Heater Co., Martins Ferry, $9,110***electrical work, to Westgate Electric Shop, 2772 West Broad St., Columbus, $2,921. Grand total $111,969. **P.W.A.** Noted Nov. 29, C. D.—Dec. 5, E. N.-R.

O., Upper Arlington — Bd. Educ., general contract constructing school, to Boyajohn & Barr, 999 South Front St., Columbus, $213,998 ***plumbing and heating, to S. A. Esswein Heating & Plumbing Co., 546 West Broad St., $48,311***electrical work, to L. R. Kennedy, 565 Fairwood Ave., $14,678. Grand total $276,987. **P.W.A.** Noted Sept. 5, C. D.—Sept. 12, E. N.-R.

Ore., Estacada—Bd. Educ., constructing high school, to Allyn & Powers, Portland, $172,685.

Ore., Salem—State Bd. Control, constructing state tuberculosis hospital addition, Dougan-Hammond Constr. Co., Rothschild Bldg., Portland, $93,307. **P.W.A.** Bids Dec. 31 Noted Jan. 7, C. D.

Pa., Bridgeville—School Dist. Boro of Bridgeville, alterations and additions to heating and ventilating system in Lincoln School and new heating and ventilating in Washington School building, to McGinness, Smith & McGinness, 527 1st Ave., Pittsburgh, $48,884. **P.W.A.**

Pa., Williamsport — Comrs. Lycoming Co., brick, steel almshouse in Loyalsock Twp., to W. E. Springman, Williamsport, $224,685***heating and power plant, also plumbing, to E. Keeler Co., Williamsport, $26,765 and $15,950 respectively***refrigeration, to Neyhart's, Inc., Williamsport, $796. Grand total $268,195.

Pa., Wyoming — Wyoming School Dist., 36 Breese St., Wyoming, 2 story, basement, 150x300 ft., brick, rein.-con., steel high school, 10 classrooms, gymnasium and auditorium, to A. Grosek, 102 Merrit St., Plains, $194,472. **P.W.A.** Mack & Sahn, 22 North Franklin St., Wilkes-Barre, archts.

R. I., Howard (Cranston)—State, State House, Providence, 2 ward buildings for women at State Hospital, to Matthew Cummings Co., 43 Tremont St., Boston, Mass., $392,500. **P.W.A.** Bids Dec. 9, awarded Dec. 2. Noted Dec. 17, C. D.

R. I., Providence—Rhode Island School of Design, 11 Waterman St., heating for school, College and Benefit Sts., to Hartwell Co., Inc., 87 Weybosset St.***plumbing, to American Plumbing Co., 205 South Main St.***electrical work, to Scannevin & Potter, 189 Pine St. Noted Nov. 25, C. D.—Nov. 28, E. N.-R., under "Contracts Awarded."

★ **Tenn., Chattanooga**—T. H. McMillan, City Hall, to Forcum-James Co., Nashville, addition to Chattanooga High School, $220,250; Sunnyside School, $53,100***to Mark K. Wilson Co., Power Bldg., Hardy Jr. High School, $104,947; foundation only for vocational school, $8,788; Hemlock School, $46,583***to R. E. Barnes Constr. Co., Volunteer Bldg., West Side Elementary School, $121,800; foundation only for East Lake School, $2,510; foundation only for Oak Grove School, $1,134; Orchard Knob School, $115,112***to Smith Bros., 213 East 10th St., Clifton Hills School, $39,302***to A. F. Hahn, Chamberlain Bldg., East 5th St. School, $139,419***to John Martin Co., 1851 Central Ave., Avondale School, $61,136***to L. A. Warlich Constr. Co., 1851 Central Ave., astronomical observatory, $15,381. Grand total $929,464. Noted Nov. 21, C. D.

★ **R. I., Providence**—City, Bd. Contr. & Supply, City Hall, general contract Senior High School, 3 story, basement, 150x350 ft., Mt. Pleasant Ave., to Tucker Constr. Co., and C. T. Wills, Inc., 346 Washington St., Providence, approximately $1,333,391***electrical work, to Brady Electric Co., Inc., 236 Bedford St., Fall River, Mass., $65,800. **P.W.A.** Bids Oct. 14, awarded Dec. 24. Noted Oct. 17, C. D.—Oct. 24, E. N.-R.

S. C., Charleston—City Bd. School Comrs., 11 St. Philip St., 3rd story addition to Tate Hall, on St. Philip St., and 12 classroom addition, to H. P. Archer School, installing heating plant in entire building, to M. L. Stephenson, 273 East Bay St., $27,250 and $72,993 respectively. Owner has privilege of extending contract (on latter project), in 30 days to include auditorium, raising contract to $96,368. Simons & Lapham, 42 Broad St., archt.

S. C., Columbia—South Carolina University Bd., Dr. L. T. Baker, pres., brick students activities buildings and wings to Thornwell College, to M. B. Kahn Constr. Co., 714 Lady St., $194,715. **P.W.A.** Noted Dec. 27, C. D. —Dec. 5, E. N.-R.

Tenn., Nashville — City, Bd. P. Wks., City Hall, excavation for foundation for McCann Elementary School Building, Pennsylvania and 56th Aves., to Jas. Morrison, Nashville, $14,750***addition to Cohn Junior High School, Park and 48th Aves., to Adamant Stone & Roofing Co., foot of Shelby Ave., $4,697*** for West End High School, south of Elmington Park, to Bush Building Co., 805 8th Ave. North, $19,989. Grand total $39,436. **P.W.A.** Noted Dec. 5 and 6, C. D.

†**Tex., Borger** — Treas. Dpt. at office Sup. Archt., Wash., D. C., constructing U. S. Post Office, to Lindberg-Richter Co., Liberal, Kan., $52,590. Bids Dec. 12. Noted Dec. 17, C. D.

Tex., Denton—Denton Ind. School Dist., c/o J. L. Wright, 2 story, 69x159 ft. classroom, clinic, office, library and auditorium, and 1 story, 99x141 ft. 5 classrooms, office, library and auditorium, North Ward School, to A. J. Rife Constr. Co., 1913 North Harwood St., Dallas, $144,500. **P.W.A.** Awarded Dec. 31.

†**Tex., Port Arthur**—Treas. Dpt. at office Sup. Archt., Wash., D. C., constructing federal building extension and U. S. Post Office, to J. R. Barnes, Springfield, O., $173,300. Bids Dec. 27, awarded Jan. 1. Noted Jan. 6, C. D.

Tex., Port Lavaca—City, R. Thayer, secy., Contr. 1, concrete building, wharf and bulkhead, to E. Wagner, Victoria, $52,720; Contr. 2, mechanical and electrical equipment, to Southern Engine & Pump Co., Houston, $78,895. **P.W.A.** Bids Dec. 14. Noted Dec. 12, C. D.—Dec. 19, E. N.-R.

Tex., Raton—City, 5 story, basement, brick, rein.-con. frame courthouse, to W. Frank Little Constr. Co., Amarillo, $212,826. **P.W.A.** Townes & Funk, Johnson Bldg., Amarillo, engrs.

Tex., San Marcos — Southwest Texas State Teachers College, c/o Dr. C. E. Evans, pres., 3 story, brick, rein.-con., steel boys' dormitory.

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†*Federal Government*

Public Buildings (Continued)

plain found., to Hill & Combs, San Antonio, $180,500. Awarded Dec. 30. **P.W.A.** Noted Oct. 21, C. D.—Oct. 24, E. N.-R.

Tex., Waco—Bd. Educ., c/o H. L. Richey, for Junior High School, 3 story, basement, 149x260 ft., brick, rein.-con., to C. C. Ramsey, Waco, $123,750. **P.W.A.** Noted Oct. 25, C. D.—Oct. 31, E. N.-R.

Tex., Wichita Falls—Wichita Falls Junior College Dist., c/o C. H. Clark, pres., foundation for 2 story, brick, rein.-con. public school, to Reid Constr. Co., Wichita Falls, $9,814. **P.W.A.** Noted Nov. 15, C. D.—Nov. 21, E. N.-R.

Va., Lexington—Virginia Military Institute, Lexington, general contract altering 3 story, basement barracks, to Northeastern Constr. Co., Nissen Bldg., Winston Salem, N. C., $147,740. **P.W.A.**

†**Va., Strasburg**—Treas. Dpt. at office Sup. Archt., Wash., D. C., constructing U. S. Post Office, to Bonded Constr. Corp., 110 East 42nd St., New York, $48,186. Noted Dec. 27, C. D. —Dec. 5, E. N.-R.

†**Wash., Grand Coulee**—Bureau Reclamation, constructing 12 residences at Grand Coulee Dam, Columbia Basin Project, to MacDonald Building Co., Tacoma, $57,071. Bids Dec. 2. Noted Dec. 13, C. D.—Nov. 21, E. N.-R.

Wis., Oconomowoc—State, Madison, constructing new steam boiler and heating system in armory, to F. A. Emreth, Oconomowoc, $1,188. Bids Dec. 28, awarded Jan. 7.

Wis., Wyocena—Columbia Co., H. G. Holtz, chn. Building Committee, plans by Starck & Schneider Madison, 2 story, basement, 44x161 ft. and 44x198 ft. brick, steel additions to asylum. $175,000.

†**T. H., Pearl Harbor**—Yards & Docks, Navy Dpt., Wash., D. C., paint and oil storehouse, fire station and boat house, at Naval Fleet Air Base, Spec. 8003, to Young Engineering Corp., 203 Dillingham Bldg., Honolulu, Items 1 and 4, $73,379. Bids Dec. 18. Noted Nov. 26, C. D.—Dec. 5, E. N.-R.

Canada—Dpt. P. Wks., Ottawa, Ont., constructing public buildings, at Cardston, Alta., to Backon Constr. Co. Ltd., Calgary, Alta., $49,000***at Gimli, Man., to Winnipeg Supply & Fuel Co. Ltd., Winnipeg, Man., $8,579***at Lillooet, B. C., to W. M. Orr, Chilliwick, B. C., $6,775***at Penticton, B. C., to Pacific Pipe & Flume Co. Ltd., Penticton, B. C., $53,847*** constructing addition to Royal School of Artillery and Brigade Building, Tete du Point Barracks, Kingston, Ont., to Anglin-Norcross Ltd., Toronto, Ont., $47,750. Grand total $165,953.

★**B. C., Vancouver** — City, constructing 12 story, basement, rein.-con., stone city hall, plain found., 10th Ave. and Cambie St., to Carter Halls-Aldinger Co., Ltd., Taylor St., $930,000. (**Correction**—contractor's name.) Noted Jan. 7, C. D.

†**Ont., Ottawa**—Treas. Dpt. at office Sup. Archt., Wash., D. C., remodeling residence, incl. rough grading, etc., for new roadway for American Minister to Canada, to Dibblee Constr. Co., Ltd., 248 Albert St., Ottawa, $4,735. Bids Dec. 2. Noted Dec. 5, C. D.

COMMERCIAL BUILDINGS

PROPOSED WORK

Calif., Claremont—Pomona College, Claremont, plans by Allison & Allison, 1014 Edison Bldg., Los Angeles, 2 and part 3 story, new class A dormitory building at Pomona College. $200,000.

Mo., St. Louis — Midwest Development Co., c/o Illinois Terminal R.R. Co., A. P. Titus, pres., 710 North 12th Blvd., will not build 20 story, basement, 122x137 ft., brick, steel, office and passenger station, 12th Blvd. and Washington Ave. $1,250,000. Project abandoned. Mauran, Russell & Crowell, 1620 Chemical Bldg., archts.

N. Y., Baldwinsville—Seneca Hotel Co. plans hotel. $140,000. Architect not appointed. **Maturity indefinite.**

N. Y., Chappaqua—R. M. Lederere, 285 Madison Ave., New York, plans constructing group dwellings on 137 acre tract, Roaring Brook Rd., Sawmill River Parkway, $100,000 or more. Architect not appointed.

N. Y., Crestwood—Roth & Gould, Huthwin Acres, plans constructing group dwellings and tract development, Bronx River Parkway and Crestwood Ave. To exceed $100,000.

★**N. Y., New York**—Lebanon Hospital, 551 5th Ave., and Westchester and Cauldwell Aves., bids late in February, constructing 13 story brick hospital, and also plans 1 story, 40x65 ft. brick heating and power unit, Grand Concourse and Mount Eden Ave., $1,450,000. C. B. Meyers, 31 Union Sq. W., archt.

★**N. Y., Syracuse**—Syracuse University rejected bids Nov. 14, constructing excavation, foundations, for medical center building. Total est. $1,250,000. P.W.A. project. Project abandoned. Noted Dec. 2, C. D.—Nov. 7, E. N.-R.

BIDS ASKED

N. Y., **Brooklyn**—See "Contracts Awarded."
N. Y., **Eastchester**—See "Contracts Awarded."
N. Y., **Scarsdale**—See "Contracts Awarded."

CONTRACTS AWARDED

Calif., Arbuckle—Pierce Union High School Dist. Trustees, 1 story, rein.-con., high school, incl. 10 classrooms, auditorium 750 seating capacity, gymnasium, shops, to J. L. McLaughlin Co., 251 Kearny St., San Francisco, $164,861. **P.W.A.** Bids Dec. 28, awarded Jan. 2. W. E. Coffman, Forum Bldg., Sacramento, archt. Noted Dec. 23, C. D.—Dec. 19, E. N.-R.

Calif., Sacramento — Bd. Educ., Sacramento City School Dist., for Junior College library, brick, steel, to W. C. Keating, 1121 24th St., $124,920. **P.W.A.** Bids Dec. 18, awarded Jan. 3. Noted Jan. 2, C. D.—

Ky., Louisville—Hazelwood Sanatorium, Dr. Paul Turner, supt., 3 story, brick addition to children's hospital, to J. F. Russel & Co., Jackson St. and Burnett Ave., $254,000. **P.W.A.** Noted July 15, C. D.—July 18, E. N.-R.

Mass., Amherst—C. T. Wills, Inc., 286 5th Ave., New York, awarded sub-contract for reinforcing steel, to Truscon Steel Co., 38 Chauncy St., Boston, in connection with construction of gymnasium, for Amherst College, C. A. Andrews, treas.***iron, to Adler & Neilson Co., Woodside, N. Y.; excavating, to Warner Bros. & Goodwin, Inc., Sunderland***heating, to Holyoke Valve & Hydrant Co., 150 Race St., Holyoke***plumbing, to Mutual Plumbing & Heating Co., Inc., 35 South Pleasant St.***electrical work, to Interstate Electric Corp., 26 Taylor St., Springfield. Noted Dec. 17, C. D.—Dec. 26, E. N.-R., under "Contracts Awarded."

Mass., Boston—Thomas O'Connor & Co., general contractors, 238 Main St., Cambridge, cast stone for intermediate school, for City, Dpt. School Buildings, to Cambridge Cement Stone Co., 156 Lincoln St., Allston***plumbing, to Mahern, 711 Boylston St.***structural steel, to Groisser & Shlager Iron Wks., 84 Washington St., Somerville***electrical work, to Quinn Bros., 239 A. St., South Boston***painting, to M. L. McDonald Co., 365 Albany St. Noted Jan. 9, C. D.—Jan. 9, E. N.-R., under "Contracts Awarded."

N. Y., Brooklyn—A. Feingold, 1902 Avenue Avenue L, constructing 6 story apartment, 1577 East 14th St., separate contracts. $150,000. Seelig & Finkelstein, 153 Pierrepont St., archts.

N. Y., Eastchester—Hilldale Homes, Inc., 363 7th Ave., New York, constructing seventy-two 2½ story houses with garages, Park Dr., Hillsdale Section, own forces. To exceed $140,000. A. Volmer, Hastings-on-Hudson, archt. Will purchase material.

N. Y., New York—One Thousand Forty-Third Ave. Corp., c/o P. Levin, c/o A. Weiser, archt., 240 Madison Ave., 2 story store and showroom, 3rd Ave. from 61st to 62nd Sts., to Wheeler Eng. Co., 369 Lexington Ave. Est. $140,000 or more.

N. Y., Scarsdale—Certified Homes, Inc., N. W. Laubler, pres., Central Ave., constructing 60 residences, Edgemont Hills, own forces. To exceed $140,000. Owner will purchase materials. Noted Dec. 31, C. D.—Jan. 9, E. N.-R.

N. Y., Winfield — Woodside Homes Corp., 60-09 Woodside Ave., Woodside, group 2 story, brick dwellings, Laurel Hill Blvd. and 65th Pl., separate con.racts awarded. To exceed $140,000. S. M. Palm, 159-15 Northern Blvd., Flushing, archt. Noted Nov. 14, C. D.—Nov. 21, E. N.-R.

O., Cleveland Heights—A. A. Treuhaft, 2460 Fairmount Blvd., 1 story, 85x200 ft., brick, steel commercial building and theater, 3905 Mayfield Rd., to A. M. Higley Co., 2036 East 22nd St. Noted July 8, C. D.—July 11, E. N.-R.

O., Ironton—Ohio Bell Telephone, 100 North 3rd St., Columbus, 2 story, basement, 45x50 ft. telephone office building, 4th St., to F. Mathaes, 427 Dunedin Rd., Columbus. Est. $125,000 incl. equipment. Noted Aug. 15, C. D.—Aug. 22, E. N.-R.

Pa., Pittsburgh—Fisher Scientific Co., 711 Forbes St., constructing 7 story, basement, 62x113 ft. brick, steel addition to commercial building, to F. Hoffman Co., Wilkinsburg Bank Bldg., Wilkinsburg.

INDUSTRIAL BUILDINGS

PROPOSED WORK

Calif., Los Angeles—FREIGHT HOUSE, etc. Engineering Dpt. Santa Fe Railway, Kerchoff Bldg., soon lets contract 1 story, 50x400 ft., rein.-con. structural steel freight house and auto dock, on Santa Fe Ave. between 3rd and 4th Sts. $37,000. Engineering Department of the Santa Fe R. R., engrs. and archts.

Md., Baltimore—FILLING STATIONS—Gulf Refining Co., 1515 Locust St., Phila., Pa., soon lets contract constructing filling stations at Hanover and Lombard Sts., Highland Ave. and Philadelphia Rd., North Ave. and Arquith St., Glenmore Ave. and Harford Rd., Ellamont St. and Bloomingdall Rd., Woodbourne Ave. and York St., in Catonsville; 609 Frederick Rd., in Towson; and Willow Ave. and York Rd. $160,000.

BIDS ASKED

Ga., Atlanta—FREIGHT DEPOT—See "Contracts Awarded."

Ill., Peoria — PLANT — See "Contracts Awarded."

★**Mich., Dearborn**—GLASS-MELTING FURNACE—Ford Motor Co., Dearborn, taking bids furnishing, erecting glass-melting furnace in plant for manufacture of safety glass, capacity to handle glass for 125,000 sq.ft. of rough plate glass daily. Est. $500,000. Private plans.

N. Y., Burnside — CREAMERY — See "Contracts Awarded."

N. Y., Syracuse—WAREHOUSE—Jan. 20, by H. B. Henschein, archts., 59 East Van Buren St., Chicago, Ill., constructing warehouse, Erie Blvd., for J. Morrel & Co., Ottumwa, Ia. Est. exceeds $37,000. Noted Jan. 10, C. D.—Jan. 16, E. N.-R.

Tex., San Antonio—PACKING PLANT—Jan. 26, by L. D. Royer, consult. engr., Smith-Young Tower, 1 story, high ceiling, 32x107 ft., brick, clay, tile, stucco, rein.-con. packing plant, plain found., Saltillo and Brazos Sts., for Roeglin Roeglin Provision Co., Saltillo and Brazos Sts. W. E. Simpson Co., Milam Bldg., structural engrs. M. Eichenroht, Maverick Bldg., archts. Noted Oct. 29, C. D.—Oct. 21, E. N.-R.

Wis., Rice Lake—BREWERY—See "Contracts Awarded."

CONTRACTS AWARDED

Conn., Bloomfield—DAIRY BARN—Highland Dairy Co., 2120 Park St., Hartford, excavating for 1 story, 38x280 ft. and 1 story, 35x40 ft. dairy barn and milk room, to Bloomfield Constr. Co., Tunxis Ave.; general contract, to Taft Bros., Union. Est. $30,000. Private plans. Noted Dec. 18, C. D.

Conn., Bridgeport—PLANT—General Electric Co., W. Stewart Clark, works mgr., two 1 story, 80x95 ft. and one 1 story, 80x112 ft., brick, steel factory units, skylighted saw tooth roofs. 80 ft. spans, flat section precast cement tile, Boston Ave. and Bond St., to Gellatly Constr. Co., 25 Housatonic Ave. Est. $55,000.

Conn., Hartford—FACTORY ADDITION—Underwood Elliott Fisher Co., Capitol Ave., converting 4 story factory into office to house research and patent departments, Arbor St., to Allyn Wadhams Co., 15 Lewis St., $90,000.

Conn., New Haven—TERMINAL—New York, New Haven & Hartford R.R., Water St., constructing bulkheads, etc. at freight terminal, New Haven Harbor, to W. R. Alling & Co., 171 Lenox St.; dredging, to Merritt, Chapman & Scott Corp., 292 Pequot St., New London. Est. exceeds $25,000. Private plans.

Ga., Atlanta — FREIGHT DEPOT — Dixie Freight Line, Atlanta, 1 story, basement, 70x120 ft., brick, structural, steel freight and depot, day labor. E. C. Seiz, 119 Luckie St., archt.

Ill., Peoria—PLANT—R. G. LeTourneau, Inc., 220 Grant St., constructing plant addition, separate contracts. $37,000.

N. Y., Batavia—FACTORY—R. N. Reed, general contractor, structural steel for factory, to A. Feine & Sons, 140 Terrace St., Buffalo, for J. Horowitz & Son, 43 Liberty St. Noted Nov. 29, C. D.—Dec. 5, E. N.-R.

R. I., Cranston—BOTTLING PLANT, etc.—Narragansett Brewing Co., Arlington St., Providence, superstructure for 2 story, 65x240 ft., bottling plant addition, 2 story, 60x60 ft., receiving room, to Bowerman Bros., 70 Bath St., Providence, to exceed $40,000. E. M. Corbett, 49 Purchase St., Fall River, Mass., archt.

S. C., Greensboro—MILL—Greensboro Weaving Co., 120x140 ft., brick, steel mill addition (rayon fabrics), to C. W. Angle, Inc., Greensboro. Est. exceeds $37,000 with equipment.

Tex., Atreco—POLYMERIZATION UNIT—Atlantic Refining Co., Atreco, polymerization unit at oil refinery, to M. W. Kellogg Co., 225 Bway., New York. Est. exceeds $40,000.

Wis., Rice Lake—BREWERY—John G. Breunig, Bloomer, constructing brewery, separate contracts. $100,000 with equipment.

Wis., Sheboygan—WAREHOUSE—Globe Co. constructing 1 story, 75x213 ft., brick warehouse, plain found., to J. Houmes, Sheboygan.

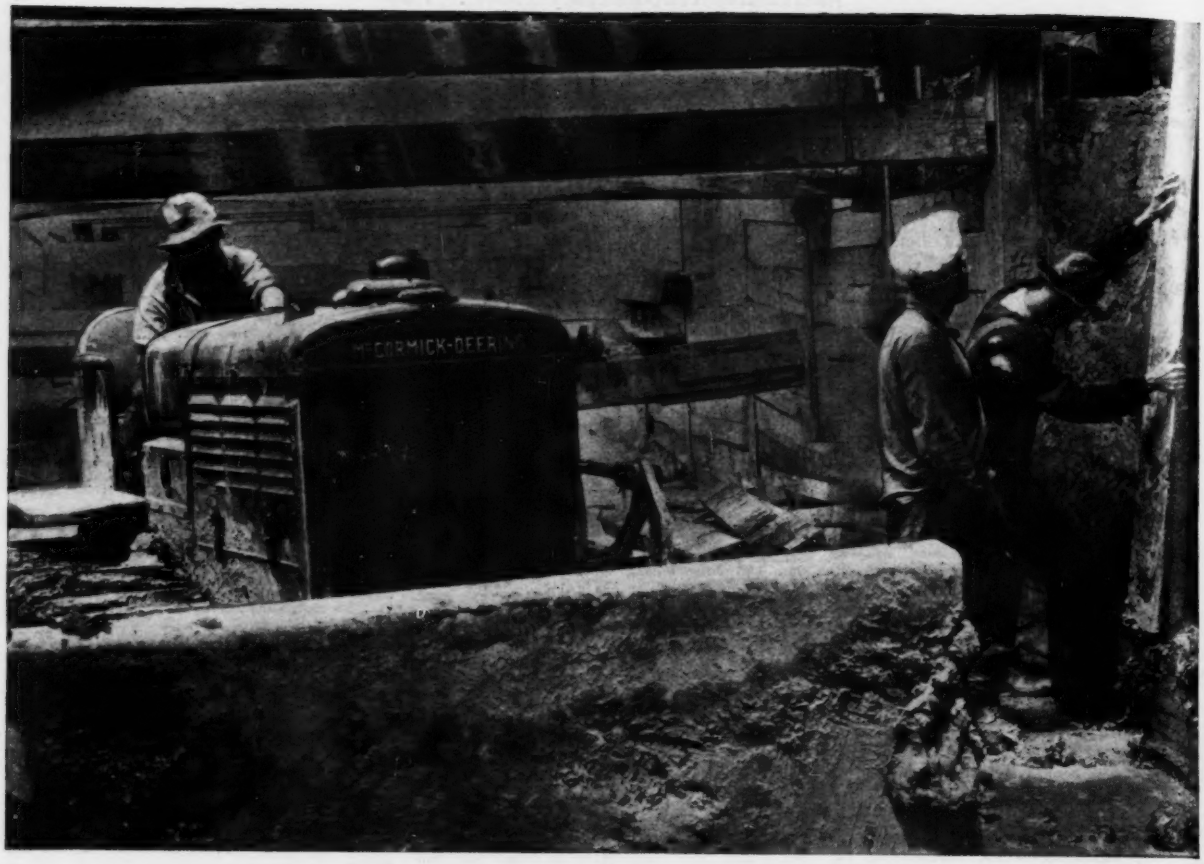
B. C., Vancouver—PLANT—Bartram Paper Products Ltd., Woodland Dr., constructing 2 story, rein.-con. addition to plant, to A. Sullivan Co., Vancouver. W. G. Swan, engr.

★**Ont., Copper Cliff** — SMELTER — International Nickel Co. of Canada, Ltd., constructing new smelter building, new high chimney, 2 furnaces, blowers, pipe lines, electrical equipment, etc., to Fraser-Brace Eng. Co., Ltd., 107 Craig St., Montreal, Que., who will be in charge of construction, with co-operation of owners' laborers under direction of staff engineers. Est. $6,000,000. Private plans. Noted Dec. 20, C. D.—Dec. 26, E. N.-R.

Ont., Toronto—FACTORY—H. K. Ferguson Co. Ltd., general contractors, 230 Bay St., superstructure for 1 story, brick, steel factory, plain found., Dundas St., for National Cash Register Co. of Canada Ltd., 1131 Bloor St. W., to Jackson Lewis Co. Ltd., 320 Bay St.*** plumbing and heating, to Geo. C. Abbott Ltd., 119 Harkord St.***auto. sprinklers, to Canadian Automatic Sprinkler Co., 68 Melrose Ave. Noted Nov. 14, C. D.—Nov. 21, E. N.-R.

Que., Valcartier—Dpt. National Defence, Ottawa, Ont., supply and installation of steam heating system at Dominion Arsenal, to O. Picard & Fils Ltd., Quebec City, $27,615.

†*Federal Government.*



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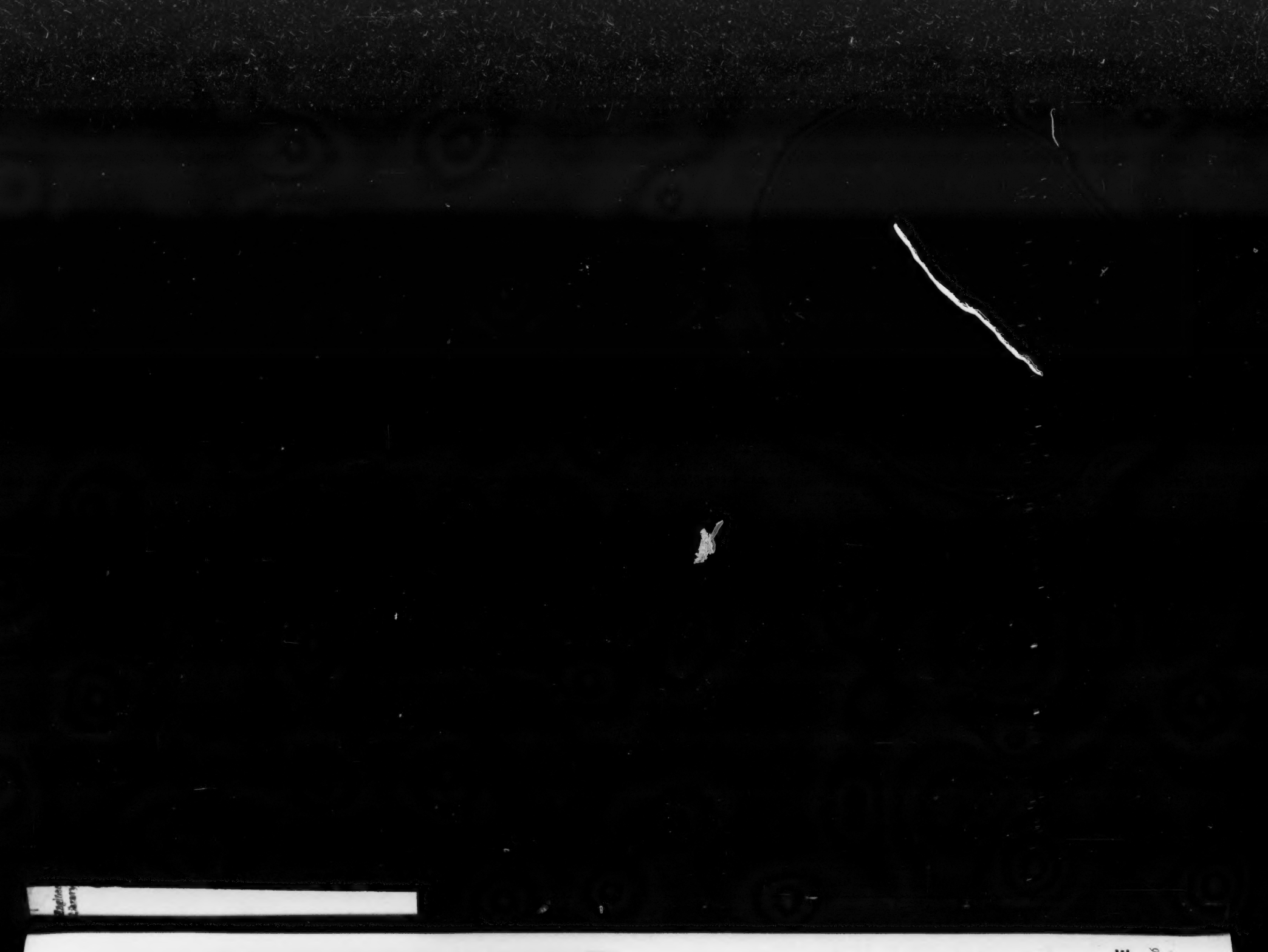
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